

**FINAL  
SAMPLING AND ANALYSIS PLAN  
(FIELD SAMPLING PLAN/QUALITY ASSURANCE PROJECT PLAN)**

**FOR THE  
  
KALISPELL POLE AND TIMBER, RELIANCE REFINERY,  
AND YALE OIL FACILITIES  
REMEDIAL INVESTIGATION**

**March 2006**

Prepared for:

**MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY  
Remediation Division  
P.O. Box 200901  
Helena, Montana 59620**

Contract Number 402014  
Contract Task Order Number 37

Prepared by:

**TETRA TECH EM INC.**  
Power Block Building, Suite 612  
7 West 6<sup>th</sup> Avenue  
Helena, Montana 59601  
(406) 442-5588

## **DISTRIBUTION LIST**

<b><u>Name</u></b>	<b><u>Responsibility</u></b>	<b><u>Affiliation</u></b>
Moriah Bucy	Remedial Project Officer	Montana Department of Environmental Quality
Brian Antonioli	Project Manager	Tetra Tech EM Inc.

**TABLE 1**  
**EPA QA/R-5 QAPP ELEMENTS**

<b>U.S. EPA QA/R-5 QAPP ELEMENT</b>		<b>TTEMI SAP</b>	
A1	Title and Approval Sheet	Title (No Approval Sheet Required for this SAP)	
A2	Table of Contents	Table of Contents	
A3	Distribution List	Distribution List	
A4	Project/Task Organization	1.4	Project Organization
A5	Problem Definition/Background	1.1	Problem Definition and Background
A6	Project/Task Description	1.2	Project Description
A7	Quality Objectives and Criteria	1.3	Quality Objectives and Criteria
A8	Special Training/Certification	1.5	Special Training and Certification
A9	Documents and Records	1.6	Documents and Records
B1	Sampling Process Design	2.1	Sampling Process Design
B2	Sampling Methods	2.2	Sampling Methods
B3	Sample Handling and Custody	2.3	Sample Handling and Custody
B4	Analytical Methods	2.4	Analytical Methods
B5	Quality Control	2.5	Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6	Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7	Instrument Calibration and Frequency
B8	Inspection/Acceptance of Supplies and Consumables	2.8	Inspection and Acceptance of Supplies and Consumables
B9	Non-direct Measurements	2.9	Non-Direct Measurements
B10	Data Management	2.10	Data Management
C1	Assessment and Response Actions	3.1	Assessment and Response Actions
C2	Reports to Management	3.2	Reports to Management
D1	Data Review, Verification, and Validation	4.1	Data Review, Verification, and Validation
D2	Validation and Verification Methods		
D3	Reconciliation with User Requirements	4.2	Reconciliation with User Requirements

Notes:

EPA            U.S. Environmental Protection Agency  
QAPP        Quality Assurance Project Plan  
SAP         Sampling and Analysis Plan  
TTEMI      Tetra Tech EM Inc.

## CONTENTS

<u>Section</u>	<u>Page</u>
DISTRIBUTION LIST .....	i
ACRONYMS AND ABBREVIATIONS .....	viii
1.0 PROJECT DESCRIPTION AND MANAGEMENT .....	1
1.1 PROBLEM DEFINITION AND BACKGROUND .....	2
1.1.1 Purpose of the Investigation .....	2
1.1.2 Problem to be Solved .....	3
1.1.3 Site Background .....	4
1.1.4 Site Description .....	4
1.1.5 Physical Setting .....	8
1.1.5.1 Soils .....	8
1.1.5.2 Groundwater Hydrology .....	8
1.1.6 Summary Of Previous and Ongoing Investigations .....	8
1.1.7 Principal Decision Makers .....	9
1.1.8 Technical or Regulatory Standards .....	9
1.2 PROJECT DESCRIPTION.....	10
1.2.1 Project Objectives .....	10
1.3 QUALITY OBJECTIVES AND CRITERIA .....	14
1.3.1 Data Quality Objectives .....	14
1.3.2 Project Measurements .....	31
1.3.3 Project Quality Assurance Objectives .....	32
1.3.3.1 Precision .....	33
1.3.3.2 Accuracy .....	33
1.3.3.3 Representativeness.....	34
1.3.3.4 Completeness.....	34
1.3.3.5 Comparability .....	35
1.3.3.6 Detection and Quantitation Limits.....	35
1.4 PROJECT ORGANIZATION AND SUBCONTRACTORS.....	36
1.4.1 Subcontractors .....	36
1.4.2 Agency Oversight.....	40
1.4.3 Non-Agency Observation of Field Activities .....	40



## CONTENTS (Continued)

1.5	SPECIAL TRAINING AND CERTIFICATION .....	41
1.5.1	Health And Safety Training .....	41
1.5.2	Subcontractor Training.....	42
1.6	DOCUMENTS AND RECORDS.....	42
1.6.1	Field Documentation .....	42
1.6.2	Summary Data Package.....	43
1.6.3	Full Data Package.....	44
1.6.4	Data Package Format .....	44
1.6.5	Reports Generated.....	47
2.0	DATA GENERATION AND ACQUISITION .....	47
2.1	SAMPLING PROCESS DESIGN .....	47
2.1.1	Investigation of Source Areas .....	58
2.1.1.1	Source Areas - Soil Borings/Monitoring Wells and Soil Sampling .....	58
2.1.1.2	Source Areas - Monitoring Well Construction .....	59
2.1.1.3	Source Areas - Monitoring well Development .....	59
2.1.1.4	Source Areas - Additional Soil Borings and Subsurface Soil Sampling .....	59
2.1.1.5	Source Areas - Surface Soil Sampling.....	60
2.1.1.6	Source Areas - LNAPL Investigation.....	60
2.1.2	Investigation of Nature, Extent, and Migration of COPCs .....	61
2.1.2.1	Nature and Extent - Surface Soil Sampling .....	61
2.1.2.2	Nature and Extent - Subsurface Soil Sampling.....	63
2.1.2.3	Nature and Extent - Groundwater Sampling of Unconfined Aquifer .....	63
2.1.2.4	Nature and Extent - Groundwater Sampling of Confined Aquifer .....	65
2.1.2.5	Nature and Extent - Surface Water and Sediment Sampling .....	65
2.1.2.6	Nature and Extent - Surface Water and Groundwater Interaction .....	66
2.1.2.7	Nature and Extent - Unconfined Aquifer Characterization.....	66
2.1.2.8	Nature and Extent - Background Investigation .....	67
2.1.3	Investigation to Support Risk Characterization.....	68
2.1.3.1	Risk - Surface Soil .....	68
2.1.3.2	Risk - Subsurface Soil .....	69
2.1.3.3	Risk - Groundwater .....	70
2.1.3.4	Risk - Surface Water.....	70
2.1.3.5	Risk - Sediments.....	71
2.1.4	Investigation to Support Evaluation of Remedial Alternatives .....	71
2.1.5	Rationale for Selecting Analytical Parameters.....	72
2.1.6	Surveying .....	73
2.1.7	Underground Utility Location and Clearance .....	73
2.1.8	Access Arrangements .....	74

## CONTENTS (Continued)

2.2	SAMPLING METHODS .....	74
2.2.1	Sampling Methods And Equipment .....	74
2.2.1.1	Monitoring Well Installation.....	75
2.2.1.2	Monitoring Well Development and Sampling .....	76
2.2.1.3	Groundwater Sample Collection .....	77
2.2.1.4	Soil Sampling.....	78
2.2.1.5	Surface Water Sampling .....	78
2.2.1.6	Surface Soil Sampling.....	82
2.2.1.7	Sludge and Sediment Sampling .....	83
2.2.2	Decontamination .....	83
2.2.3	Management Of Investigation-Derived Waste.....	84
2.2.4	Sample Containers And Holding Times.....	85
2.3	SAMPLE HANDLING AND CUSTODY .....	85
2.3.1	Sample Identification .....	86
2.3.2	Sample Labels .....	88
2.3.3	Sample Documentation .....	89
2.3.4	Chain Of Custody.....	89
2.3.5	Sample Shipment.....	90
2.4	ANALYTICAL METHODS .....	91
2.4.1	Selection Of Analytical Laboratories .....	92
2.4.2	Project Analytical Requirements .....	93
2.5	QUALITY CONTROL.....	94
2.5.1	Field Quality Control Samples .....	95
2.5.1.1	Field Duplicates .....	95
2.5.1.2	Source Water Blanks and Trip Blanks.....	96
2.5.1.3	Equipment Rinsate Samples .....	96
2.5.2	Laboratory Quality Control Samples .....	97
2.5.2.1	Matrix Spike and Matrix Spike Duplicates.....	97
2.5.2.2	Method Blanks.....	97
2.5.2.3	Laboratory Control Samples or Blank Spikes .....	98
2.5.2.4	Surrogate Standards .....	98
2.5.2.5	Internal Standards .....	99
2.5.3	Additional Laboratory Quality Control Procedures .....	99
2.5.3.1	Method Detection Limit Studies.....	99
2.5.3.2	Sample Quantitation Limits .....	99

## CONTENTS (Continued)

2.5.3.3	Control Charts.....	100
2.6	EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE.....	100
2.6.1	Maintenance of Field Equipment .....	100
2.6.2	Maintenance of Laboratory Equipment.....	101
2.7	INSTRUMENT CALIBRATION AND FREQUENCY .....	101
2.7.1	Calibration of Field Equipment .....	101
2.7.2	Calibration of Laboratory Equipment .....	102
2.8	INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES .....	102
2.9	DATA MANAGEMENT .....	103
2.9.1	Data Pathways .....	103
2.9.2	Data Management Strategy .....	104
3.0	ASSESSMENT AND OVERSIGHT.....	104
3.1	ASSESSMENT AND RESPONSE ACTIONS .....	104
3.1.1	Field Assessments .....	104
3.1.2	Field Corrective Action Procedures .....	105
3.1.3	Laboratory Corrective Action Procedures.....	106
3.2	REPORTS TO MANAGEMENT.....	106
3.2.1	Daily Progress Reports.....	107
3.2.2	Project Monthly Status Report .....	107
4.0	DATA VALIDATION AND USABILITY .....	107
4.1	DATA REVIEW, VERIFICATION, AND VALIDATION .....	108
4.1.1	Field Data Verification .....	108
4.1.2	Laboratory Data Verification .....	108
4.1.3	Laboratory Data Validation.....	109
4.1.3.1	Full Data Validation .....	109
4.1.3.2	Cursory Data Validation .....	109
4.1.3.3	Data Validation Criteria.....	109
4.2	RECONCILIATION WITH USER REQUIREMENTS .....	112
	REFERENCES .....	113

## CONTENTS (Continued)

### **Appendix**

A	METHOD PRECISION AND ACCURACY GOALS
B	STANDARD OPERATING PROCEDURES AND USEPA INTERIM POLICY
C	FIELD FORMS
D	PROJECT-REQUIRED REPORTING LIMITS AND PRELIMINARY REMEDIATION GOALS
E	LABORATORY INFORMATION
F	SUMMARY OF PROPOSED SAMPLES AND ANALYSES
G	WELL FIGURES

### **FIGURES**

<b><u>Figure</u></b>	<b><u>Page</u></b>
1	LOCATION MAP ..... 5
2	VICINITY MAP ..... 6
3	PROPERTY OWNERSHIP MAP ..... 7
4	PROJECT ORGANIZATION CHART ..... 39
5A	PROPOSED SURFACE SOIL SAMPLING LOCATIONS ..... 54
5B	PROPOSED SUBSURFACE SOIL SAMPLING LOCATIONS ..... 55
5C	PROPOSED MONITORING WELL LOCATIONS ..... 56
5D	PROPOSED SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS ..... 57

### **TABLES**

<b><u>Table</u></b>	<b><u>Page</u></b>
1	EPA QA/R-5 QAPP ELEMENTS ..... ii
2	IMPLEMENTATION SCHEDULE FOR REMEDIAL INVESTIGATION ..... 10
3	DATA QUALITY OBJECTIVES
3A	Source Areas ..... 15
3B	Investigation of Nature, Extent, Migration of COPCs ..... 19
3C	Investigation to Support Risk Characterization ..... 24
3D	Investigation to Support Evaluation of Remedial Alternatives ..... 29
4	QUALITY CONTROL SAMPLES FOR PRECISION AND ACCURACY ..... 32
5	PROJECT PERSONNEL ..... 37
6	REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES ..... 45
7	PROPOSED SOIL AND GROUNDWATER SAMPLES, ANALYSES, AND OBJECTIVES ..... 49
8	SUMMARY OF SOIL AND GROUNDWATER ANALYSES ..... 52
9	SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS ..... 79
10	FIELD QC SAMPLES ..... 95
11	DATA VALIDATION CRITERIA ..... 110

## ACRONYMS AND ABBREVIATIONS

AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, xylene
°C	Degrees Celsius
CECRA	Montana Comprehensive Environmental Cleanup and Responsibility Act
CFR	Code of Federal Regulations
CLP	Contract laboratory program
COPC	Contaminant of potential concern
DAF	Dilution attenuation factor
DEQ	Montana Department of Environmental Quality
DEQ-7	DEQ Circular 7
DEQ/RD	DEQ/Remediation Division
DQA	Data quality assessment
DQO	Data quality objective
EDD	Electronic data deliverable
EPA	U.S. Environmental Protection Agency
EPH	Extractable petroleum hydrocarbons
FS	Feasibility Study
FSP	Field sampling plan
GC/MS	Gas chromatograph/mass spectrometer
HSA	Hollow stem auger
HASP	Health and safety plan
ICP	Inductively coupled plasma
IDW	Investigation-derived waste
KRY	Kalispell Pole and Timber, Reliance Refinery, and Yale Oil Facilities
LCS	Laboratory control spike
LNAPL	Light, non-aqueous phase liquid
LRRL	Laboratory required reporting limit
MCA	Montana Code Annotated
MDL	Method detection limit
mg/kg	Milligrams per kilogram
mL	Milliliter
MS	Matrix spike
MSD	Matrix spike duplicate
MNA	Monitored natural attenuation
MSR	Monthly status report
MW	Monitoring well

## ACRONYMS AND ABBREVIATIONS (Continued)

OHSC	Onsite health and safety coordinator
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PCB	Polychlorinated biphenyl
PCP	Pentachlorophenol
PID	Photoionization detector
PLP	Potentially liable persons
PO	Project officer
POTW	Publicly owned treatment works
PPE	Personal protective equipment
PRG	Preliminary remediation goal
PRRL	Project-required reporting limit
PTS	Pioneer Technical Services, Inc.
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
QAPP	Quality assurance project plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
RIWP	Remedial Investigation Work Plan
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
SDG	Sample delivery group
SLERA	Screening level ecological risk assessment
SOP	Standard operating procedure
SOW	Statement of work
SPLP	Synthetic precipitation leaching procedure
SQL	Sample quantitation limit
SSL	Soil screening level
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total organic carbon
TSA	Technical systems audit
TTEMI	Tetra Tech EM Inc.
µg/L	micrograms per liter
USDA	U.S. Department of Agriculture
VPH	Volatile petroleum hydrocarbons
VOA	Volatile organic analysis
VOC	Volatile organic compound
WRI	Western Research Institute

## **1.0 PROJECT DESCRIPTION AND MANAGEMENT**

Tetra Tech EM Inc. (TTEMI) received Task Order No. 37, from the Montana Department of Environmental Quality, Remediation Division (DEQ/RD), under DEQ Contract No. 402014. The purpose of this task order is to perform services necessary to complete a Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Remedial Investigation (RI), risk assessment and feasibility study (FS) for the Kalispell Pole and Timber (KPT) Facility, Reliance Refinery Company (Reliance) Facility and the Yale Oil Corporation (Yale Oil) Facility. The three facilities are herein referred to as the KRY site. In support of this effort, TTEMI prepared an RI work plan (RIWP) as requested under Task No. 3 of this task order.

This document is a combined field sampling plan (FSP) and quality assurance project plan (QAPP), and is herein referred to as a sampling and analysis plan (SAP). It has been prepared as an attachment (Attachment 1) to the RIWP. A health and safety plan (HASP) has also been prepared, and is provided as Attachment 2 to the RIWP.

The KRY site is located on the northeastern edge but outside of the city limits of the City of Kalispell in Flathead County, Montana. The three facilities are close to each other, near residential and commercial areas, and occupy a total area of approximately 55 acres south of the Stillwater River. Groundwater contamination from each of these facilities is commingled in the shallow aquifer. Contaminants of potential concern (COPCs) include pentachlorophenol (PCP), dioxins and furans, polycyclic aromatic hydrocarbons (PAH), diesel-range petroleum hydrocarbons, and metals, most notably lead.

Site assessment activities were conducted by the U.S. Environmental Protection Agency (EPA) and the Montana Department of Health and Environmental Services (predecessor to DEQ) at the three facilities from 1985 to 1996. Investigations were conducted to characterize contamination in soils, sludge, and groundwater and to gather historical data for CERCLA purposes. A draft hazard ranking score package was developed for the KPT and Reliance facilities which indicated that the facilities were candidates for the federal National Priorities List.

Table 1 follows the distribution list page at the beginning of this SAP. The table demonstrates how this SAP addresses QAPP elements currently required by the U.S. EPA QA/R-5 guidance document (EPA 2001).

In this document, tables and figures follow the first reference in the text. Appendix A contains method, precision and accuracy goals, Appendix B contains TTEMI standard operating procedures (SOP) and additional sampling guidance from DEQ, Appendix C contains all field forms, Appendix D lists project-required reporting limits (PRRL), Appendix E provides analytical laboratory information approved for use under the DEQ contract, Appendix F provides a table summary of all samples that have been proposed in this SAP, and Appendix G provides monitoring well construction specifications.

## **1.1 PROBLEM DEFINITION AND BACKGROUND**

This section describes the following:

- Purpose of the Investigation (Section 1.1.1)
- Problem to be Solved (Section 1.1.2)
- Site Background (Section 1.1.3)
- Site Description (Section 1.1.4)
- Physical Setting (Section 1.1.5)
- Summary of Previous Investigations (Section 1.1.6)
- Principal Decision Makers (Section 1.1.7)
- Technical or Regulatory Standards (Section 1.1.8)

### **1.1.1 Purpose of the Investigation**

The purpose of the investigation and general investigation objectives for the KRY site are to:

- Investigate the nature and extent of suspected sources of contamination located at the KRY site. This includes investigating (1) the source of the PCP, dioxins and furans, PAHs, diesel-range petroleum hydrocarbons groundwater plumes and associated soil contamination in the KPT source area, (2) the source of groundwater and soil contamination, notably sludges, oily wastes, petroleum hydrocarbons, and lead in the Reliance source area, and (3) the source of petroleum hydrocarbons in soils in the Yale Oil source area. This investigation will focus on delineating the lateral and vertical extent of soil contamination in these areas and will also investigate the presence and extent of measurable (greater than 0.1 foot [ft] in thickness) light, non-aqueous phase liquid (LNAPL).
- Investigate potential sources of contamination in the vicinity of Montana Mokko, Inc. and Stillwater Forest Products, Inc. including leaking drums, uncontainerized waste, abandoned above ground fuel storage tanks, and septic drainfields that may be associated with maintenance shops.
- Investigate the nature, extent and migration of contamination throughout the KRY site. This investigation will focus on delineating the lateral and vertical extent of groundwater contamination downgradient of the suspected source areas, including the delineation of



groundwater contamination east of Highway 2. In addition, data collected from this investigation will be used to further assess aquifer characteristics, surface water and sediment contamination, surface water and groundwater interaction, and the extent of any additional surface soil contamination at, or close to the site. Lastly, samples will be collected to establish background concentrations of contaminants in both soil and groundwater.

- Characterize the risks at the site. This investigation will gather data needed to evaluate risks to human health and the environment. The investigation will characterize (from a risk assessment standpoint) contaminated media and identify likely exposure pathways and receptors. Note that risks will not be calculated for DEQ-7 constituents in groundwater.
- Gather data needed to evaluate likely remedial alternatives. This investigation will gather data to support some likely remedial alternatives that can be identified at this time. These include soil excavation, onsite treatment, offsite disposal, in-situ groundwater treatment, in-situ soil treatment, and LNAPL recovery with offsite disposal. A complete identification and evaluation of alternatives will be conducted in the FS.

In general, new data will be collected to augment previous investigations, and will be used to establish background concentrations of constituents, identify contaminant sources, evaluate pathways of migration, assess risk (except as noted above), and evaluate remedial alternatives at the KRY site. To achieve these goals, site-specific sampling needs are identified in this SAP and the rationale for each sample is provided. The optimized sample design includes:

- Collection of groundwater quality data;
- Collection of aquifer characterization data;
- Collection of data to characterize soils and soil contaminants;
- Collection of data to establish background concentrations of contaminants in soil, and upgradient or upstream concentrations of contaminants in groundwater or surface water;
- Collection of data to characterize sludges and oily waste;
- Collection of data to estimate measurable LNAPL thickness in groundwater;
- Collection of surface water quality data; and
- Collection of data to characterize river sediments.

New data will supplement the information compiled in previous site investigations (presented in Section 1.1.6). All available site data will then be incorporated in an RI report.

### **1.1.2 Problem to be Solved**

Previous investigations at the KRY site indicated there have been past releases of COPCs. These investigations did not fully characterize the extent and magnitude of PCP, dioxins, furans, PAHs, diesel-range petroleum hydrocarbon, and metals contamination in soils (particularly subsurface soils) by

potential sources in three locations (KPT area, Reliance area, and Yale Oil area). However, the investigations identified concentrations of constituents in groundwater that exceeded State standards, and which may continue to pose a threat to human health and the environment. In addition, the nature, extent, and migration pathways of contaminants in groundwater and soils need to be more fully characterized. Furthermore, the effectiveness of ongoing groundwater remediation activities at the KPT facility is uncertain. Lastly, additional data needs related to assessing human health and environmental risks, and additional data needs associated with the development of remedial alternatives have been identified.

### **1.1.3 Site Background**

A detailed overview of the operational and property ownership history for the KPT, Reliance, and Yale Oil Facilities is provided in the Final Data Summary Report (DSR) (TTEMI 2006), and is not repeated here. The DSR also provides a summary of the current ownership of the individual parcels in each facility and historical property ownership. In addition, a number of investigations, interim actions, and response actions have been conducted at the KRY site and are summarized in the DSR.

### **1.1.4 Site Description**

The KRY site is located on the northeastern edge of the City of Kalispell in Flathead County, Montana (Figure 1). The site is located in Sections 5 and 8, Township 28 North, Range 21 West of the Montana Principal Meridian. The approximate boundaries of the KRY site extend from the Stillwater River on the north and west, Highway 2 and the BNSF Railway Company railroad on the east, and Montclair Drive on the south (Figure 2). The fenced area northeast of Reliance and adjacent to (east of) the railroad tracks is also part of the Reliance facility. The KRY site encompasses approximately 55 acres.

Land use includes a mix of residential, commercial, industrial, and open space (Figure 3). Examples of commercial and light-industrial businesses in the area include lumber processing, open-cut gravel mining, recycling, retail stores, storage, and a motel. Sources of domestic water in the vicinity of the KRY site are from the Evergreen Water District Public Water Supply and private wells.

In addition, other domestic (such as irrigation), commercial, industrial, and nondomestic use water is known to come from the shallow aquifer via several individual wells. Sewage disposal in the vicinity is provided by individual septic systems and public sanitary systems.

Figure 1

Figure 2

Figure 3

### **1.1.5 Physical Setting**

The KRY site is located south of and adjacent to the Stillwater River on bottom lands and low terraces at an elevation of 2,920 ft above mean sea level, one-half mile above the confluence of the Stillwater and Whitefish rivers. Topography across the site is typical of a relatively flat broad floodplain containing fluvial materials ranging from clay- to cobble-sized (ThermoRetec 2001). These deposits are characteristic of a high-energy system with occasional quiescent periods (EPA 1992a). In general, runoff from the site drains to the north and east towards the Stillwater River. Variations in topography include a bench/terrace at the KPT facility and an elevated railroad spur line and main line at the Reliance facility. Physical setting attributes are more fully described in Section 2.0 of the main body of the RIWP and in the data summary report (TTEMI 2006).

#### **1.1.5.1 Soils**

The soil types found at the KPT, Reliance, and Yale Oil facilities are dominated by material that has been deposited by the nearby Stillwater River or streams. Soil types found at each site are described in detail in Section 2.7 of the main body of the RIWP.

#### **1.1.5.2 Groundwater Hydrology**

Subsurface geology in the project area consists of fluvial materials ranging in size from clay to cobbles (ThermoRetec 2001). Wells drilled during previous investigations have extended to a maximum depth of 135 ft below ground surface (bgs). In general, the upper 30 ft is dominated by interbedded and intermixed sand and gravel, with cobbles, silty sand, and clay also reported (RETEC 1995; ThermoRetec 2001). The underlying material is primarily a silty sand that extends to depths that exceed 100 ft bgs. Locally, a silty clay unit, at least 15 ft thick, and up to 51 ft thick, is present at approximately 120 ft bgs (Pioneer Technical Services, Inc. [PTS] 2000; ThermoRetec 2001) and separates the upper unconfined aquifer from the deeper confined aquifer (EPA 1992a). Additional details related to groundwater hydrology are described in detail in Section 2.10 of the main body of the RIWP and in the data summary report (TTEMI 2006).

### **1.1.6 Summary of Previous and Ongoing Investigations**

A detailed description of the individual investigations and findings can be found in the data summary report for the KRY site (TTEMI 2006), and is not repeated here. Based on the findings presented in

previous investigations, it was determined that further investigation of the KRY site was warranted because there was a potential threat to human health and the environment.

#### **1.1.7 Principal Decision Makers**

The principal decision maker and technical lead for this RI is the DEQ/RD. The DEQ/RD Project Officer for this site is Ms. Moriah Bucy.

#### **1.1.8 Technical or Regulatory Standards**

Concentrations of constituents in surface water and groundwater at the KRY site will be screened using State standards presented in Water Quality Bureau Circular DEQ-7 (DEQ/Planning, Prevention, and Assistance Division 2006). These standards include aquatic life and human health standards for surface water and groundwater. Human health standards may be equivalent to the federal maximum contaminant levels. Concentrations of constituents in soils, sediments and sludges will be compared to soil values from EPA Region 9 preliminary remediation goals (PRG) (EPA 2004), soil screening levels (SSL) (with a dilution attenuation factor [DAF] of 10), and Risk Based Screening Levels (RBSL) from Montana's Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (RBCA) guidance per DEQ's Voluntary Cleanup and Redevelopment Act (VCRA) Guide (DEQ 2002). Specifically, DEQ's VCRA Guide recommends comparison of sediment concentrations to Washington State Department of Ecology Freshwater Sediment Quality Values (Washington State 1997) or U.S. Department of Energy (DOE) Preliminary Remediation Goals for Ecological Endpoints (DOE 1995 and 1997). Additionally, concentrations of constituents in sludges will also be compared to Resource Conservation and Recovery Act (RCRA) toxicity characteristic leaching procedure (TCLP) regulatory limits for disposal and treatment purposes (Table 1 of 40 Code of Federal Regulations [CFR] 261.24).

At this time, COPCs identified by DEQ include PCP, dioxins and furans, PAHs, diesel-range petroleum hydrocarbons, and lead. In addition, TTEMI screened all solid and liquid matrix sample results collected previously to establish a list of analytes that were present in more than five percent of the samples above laboratory detection limits, and which for the purpose of the RI may potentially be considered COPCs (for example semivolatile organic compounds [SVOC] and volatile organic compounds [VOC]). The full list of analytes is provided in Appendix D, Table D-1. Other COPCs may be identified during the RI. Screening values and reporting limits for selected analytes are presented in Appendix D, Table D-2 and Table D-3. PRGs are presented for informational purposes and for initial screening of analytical results obtained for the KRY site, and may not necessarily represent site-specific cleanup goals.

In addition, technical and regulatory standards used as screening criteria are compared to the PRRL selected for this investigation. This comparison is made to ensure that the required reporting limit is less than the screening criterion used, or to identify cases where analytical methods may not meet PRRLs. This comparison is presented in Appendix D, Table D-2 for water, and Appendix D, Table D-3 for soils. State standards provided in DEQ-7 were used to establish PRRLs. Further discussion of PRRLs is provided in Section 1.3.3.6 of this SAP.

## 1.2 PROJECT DESCRIPTION

The following subsections discuss the objectives and measurements of the project. Table 2 presents a schedule of sampling, analysis, and reporting for this investigation.

**TABLE 2**  
**IMPLEMENTATION SCHEDULE FOR THE REMEDIAL INVESTIGATION**

Task	Start Date	End Date	Duration <sup>a</sup>
Draft RIWP	July 1, 2005	October 31, 2005	120
DEQ comment period on Draft RIWP	October 31, 2005	February 16, 2006	108
Incorporate comments on Draft RIWP	February 17, 2006	March 8, 2006	20
DEQ comment period on Draft Final RIWP	March 8, 2006	March 15, 2006	7
Prepare Final RIWP	March 16, 2006	March 22, 2006	7
Conduct field sampling	April 17, 2006	June 30, 2006	75
Receive data (35 day turnaround)	August 7, 2006	August 7, 2006	1
Analytical data validation	August 8, 2006	September 7, 2006	30
Evaluate data and incorporate results into RI Report	June 1, 2006	September 30, 2006	120

Notes:

- <sup>a</sup> Duration in calendar days  
 DEQ Department of Environmental Quality  
 RI Remedial Investigation  
 RIWP Remedial Investigation Work Plan  
 TBD To be determined

### 1.2.1 Project Objectives

Project objectives are organized into four logical investigation components for this SAP. These investigation components include:

- Investigation of source areas
  - KPT Area Investigation
  - Reliance Area Investigation
  - Yale Oil Area Investigation



- Investigation of nature, extent, and migration of COPCs
- Investigation to support risk characterization
- Investigation to support evaluation of remedial alternatives

These investigation components together form a larger and integrated site-wide investigation; and based on the stated objectives, an assortment of groundwater, surface water, surface soil, subsurface soil, sediment and sludge/oily waste samples will be collected that will meet the objectives of one or more of these primary investigation types. Some samples satisfy individual objectives for a single investigation component, while other samples will satisfy multiple objectives for several investigation components. All samples proposed in this SAP are organized by their corresponding investigation component and matrix type in Appendix F, Table F-1.

The primary objectives of the proposed field activities at the KRY site can be summarized as follows:

#### **Investigation – Source Areas**

- Further investigate the nature and extent of suspected sources in the KPT area
- Further investigate the nature and extent of suspected sources in the Reliance area
- Further investigate the nature and extent of suspected sources in the Yale Oil area
- Delineate the lateral extent of soil contamination in the zone of water table fluctuation (smear zone) that may continue to act as a long-term source of contamination to groundwater
- Investigate the areal extent of measurable LNAPL.

#### **Investigation - Nature, Extent, and Migration of COPCs**

- Further delineate the lateral and vertical extent of soil contamination at the KRY site
- Further investigate the nature, extent, and migration of contamination in groundwater
- Further characterize the aquifer
- Evaluate the concentrations of COPCs, if any, in surface water and sediment in the Stillwater River
- Further characterize the movement of groundwater near the Stillwater River
- Evaluate background concentrations of COPCs in soil, surface water, sediment, and groundwater

### **Investigation – To Support Risk Characterization**

- Gather necessary data to quantify the human health and environmental risks at the site
- Characterize (from a risk assessment standpoint) contaminated media
- Identify likely exposure pathways and receptors

### **Investigation – To Support Evaluation of Remedial Alternatives.**

- Gather data needed to support evaluation of likely remedial alternatives (Some likely remedial alternatives can be identified at this time, although a complete identification and evaluation of alternatives will not be conducted until the FS.)
- Gather data needed to evaluate the effectiveness and impacts of the existing groundwater ozonation system at the KPT facility

To meet these objectives, the following field activities will be conducted at the KRY site under this project:

### **Investigation of Source Areas**

#### KPT

- Soil samples will be collected within the central portion of the facility near the former treating vats to delineate the extent of contaminated soil not previously removed.
- A boring will be advanced, a monitoring well will be installed, and soil and groundwater quality samples will be collected at a location near existing above ground storage tanks (AST).
- Soil samples will be collected on the north side of the facility where leaking drums were observed during October 2005 site reconnaissance.
- Soil samples will be collected in the smear zone at locations where contamination may be acting as a continuing source of contamination to groundwater.
- The areal extent of measurable LNAPL will be estimated by installing LNAPL monitoring wells and measuring product thickness in these wells.

#### Reliance

- Soil samples will be collected near two areas where crude oil spills and surface deposits of sludge have been observed.
- Monitoring wells will be installed near two areas where crude oil spills and surface deposits of sludge have been observed.
- Soil samples will be collected in the smear zone at locations where soil contamination may be acting as a continuing source of contamination to groundwater
- The areal extent of measurable LNAPL will be estimated by installing LNAPL monitoring wells and measuring product thickness in these wells.

### Yale Oil

- Soil samples will be collected on the northeast side of the facility near the former oil warehouse and road oil tanks.
- Soil samples will be collected on the northwest side of the facility where the foundation of an historic oil pump house and floor drains were observed during recent site reconnaissance.

### **Investigation of Nature, Extent, and Migration of COPCs**

- The locations of newly proposed and existing monitoring wells, and all new and existing surface water stations will be surveyed.
- Static water level measurements will be collected from newly proposed monitoring wells and all accessible existing wells.
- Groundwater quality data will be collected from newly proposed monitoring wells and selected existing monitoring wells.
- Surface soil samples will be collected to establish background concentrations in soils.
- Data will be collected describing aquifer thickness, depth to aquitards or confining units, and related lithology from newly installed soil borings to be completed as monitoring wells.
- Soil samples will be collected from newly proposed monitoring well borings.
- Surface and subsurface soil samples will be collected adjacent to areas where contamination is present to evaluate the lateral and vertical extent of contamination.
- Subsurface soil samples (unsaturated zone and saturated zone) will be collected and analyzed to estimate porosity, bulk density, and total organic carbon (TOC) in both the unsaturated zone and saturated zone.
- Aquifer testing will be conducted at selected newly installed monitoring wells to further estimate hydraulic conductivity.

### **Investigation to Support Risk Characterization**

- Surface soils will be collected and analyzed.
- Subsurface soils will be collected and analyzed.
- Surface water samples will be collected and analyzed.
- Sediment samples will be collected and analyzed.
- Groundwater samples will be analyzed for additional parameters at selected locations

## **Investigation to Support Evaluation of Remedial Alternatives**

- Groundwater samples will be analyzed to evaluate the effectiveness and impacts of the ongoing groundwater ozonation system.
- Subsurface soil samples (unsaturated zone and saturated zone) will be analyzed for bulk density, specific gravity, moisture content, grain size analysis, TOC, and pH.
- Groundwater samples will be analyzed for remediation by monitored natural attenuation (MNA) parameters by Western Research Institute.
- Selected soil samples will be analyzed for TCLP, and SPLP.

### **1.3 QUALITY OBJECTIVES AND CRITERIA**

The following sections present the data quality objectives (DQO) and quality assurance (QA) objectives identified for the proposed investigation for the KRY site.

#### **1.3.1 Data Quality Objectives**

DQOs are qualitative and quantitative statements developed through the seven-step DQO process (EPA 2000b, 2000d). The DQOs clarify the study objective, define the most appropriate data to collect and the conditions under which to collect the data, and specify tolerable limits on decision errors that will be used as the basis for establishing the quantity and quality of data needed to support decision-making. The DQOs are used to develop a scientific and resource-effective design for data collection. The seven steps of the DQO process for this project are presented in Table 3 (Tables 3A, 3B, 3C, 3D). As discussed in Section 1.2.1, project measurements have been organized into four logical investigation components. These components carry forward into the remaining sections of this SAP. Therefore, DQOs presented in Table 3 have also been organized to reflect the major investigation components discussed in Section 1.2.1; specifically:

Table 3A - Investigation of Source Areas

Table 3B – Investigation of Nature, Extent, and Migration of COPCs

Table 3C – Investigation to Support Risk Characterization

Table 3D - Investigation to Support Evaluation of Remedial Alternatives

**TABLE 3A**

**DATA QUALITY OBJECTIVES**

**INVESTIGATION OF SOURCE AREAS**

<b>STEP 1: State the Problem</b>
<p>Previous investigations at the KRY site indicated that there have been releases of COPCs. Elevated concentrations of COPCs have been found in site soil, and include PCP, dioxins and furans, petroleum hydrocarbons, and PAHs. Concentrations of COPCs in groundwater exceed State standards for these COPCs and pose a potential threat to human health and the environment.</p> <p><b>The following are problem statements associated with the source area investigation:</b></p> <ul style="list-style-type: none"> <li>• There are insufficient data to fully characterize the areal and vertical extent of contamination in source area soils near the former treating vats in the central portion of the KPT facility.</li> <li>• There are insufficient data to characterize the areal extent of LNAPL contamination at the KPT and Reliance facilities.</li> <li>• Soil contamination near the groundwater table resulting from LNAPL migration and smearing during fluctuations in the water table elevation appears to be a potential source of groundwater contamination; however, the lateral and vertical extent of the contaminated smear zone has not been fully characterized.</li> <li>• Soils and groundwater in the northern area of the KPT facility have not been previously sampled.</li> <li>• Leaking drums and a number of abandoned ASTs were observed near the approximate western boundary of the KPT facility, however no soils or groundwater data are available to characterize these potential source areas.</li> <li>• Maintenance shops and septic systems are located near the approximate western boundary of the KPT facility, however no soils or groundwater data are available to characterize these potential source areas.</li> <li>• There are insufficient data to characterize the areal and vertical extent of oil/sludge in a fenced area near residences and northeast of the Reliance facility.</li> <li>• There are insufficient data to characterize the areal extent of soil contamination that may have occurred at or near the former oil warehouse, road oil tanks, and oil pump house at the Yale Oil facility.</li> </ul>
<b>STEP 2: Identify the Decisions</b>
<ul style="list-style-type: none"> <li>• Has the areal and vertical extent of soil contamination in a known source area near the former treating vats been fully defined?</li> <li>• Has the extent of LNAPL contamination been fully characterized at the site?</li> <li>• Has the extent of the contaminated smear zone acting as a possible secondary source of contamination to groundwater been fully characterized at the site?</li> <li>• Have there been leaks or spills associated with other areas of the KRY facilities, such as the former pole storage area and area of leaking drums (at KPT), crude oil spills and sludge areas (at Reliance), and locations near former road oil tanks (at Yale Oil ), that are a potential source of contamination to soil or groundwater?</li> </ul>

**TABLE 3A**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF SOURCE AREAS**

<b>STEP 3: Identify Inputs to the Decisions</b>
<ul style="list-style-type: none"> <li>• Review of historical aerial photographs, previous investigative findings and sampling, and recent field reconnaissance.</li> <li>• Soil screening criteria including PRGs, and groundwater screening criteria including State standards such as those provided in DEQ-7.</li> <li>• Results of previous soil sampling of the surface and subsurface, and additional sampling of soils conducted as part of this investigation.</li> <li>• Measurements of LNAPL thickness collected during previous investigations and additional measurements collected as part of this investigation.</li> <li>• Results of previous groundwater monitoring conducted at the site, installation of additional new groundwater monitoring wells, and the results of monitoring well sampling conducted as part of this investigation.</li> <li>• Review of Flathead County Health Department Records for septic systems</li> <li>• Inspection of current operations (that is, wells, septic, sumps, floor drains.)</li> </ul>
<b>STEP 4: Define Study Boundaries</b>
<ul style="list-style-type: none"> <li>• The lateral extent of the study area consists of the area bounded by the north bank of the Stillwater River to the west and north, the east end of the Walmart parking lot to the east, and the southern rim of the McElroy and Wilken gravel pit to the south, although the exact boundaries cannot be determined as the extent of contamination is not known.</li> <li>• The vertical extent of the study area for surface soils, unsaturated zone soils and saturated zone soils will extend from the ground surface, through the sand and gravel aquifer, to the top of the underlying clay. The study area for groundwater primarily includes the unconfined sand and gravel aquifer.</li> <li>• Temporal boundaries include data collected since 1985 described in section 1.1.6 of this SAP, and extend through the period of performance of this investigation.</li> </ul>

**TABLE 3A**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF SOURCE AREAS**

<b>STEP 5: Develop Decision Rules</b>
<ul style="list-style-type: none"> <li>• If the magnitude and extent of soil contamination (greater than PRGs, SSLs [with a DAF of 10] or RBSLs), and groundwater contamination (greater than State standard) in source areas have been identified through proposed sampling activities, then sampling activities are considered complete and no further sampling of source areas will be necessary.</li> <li>• If the magnitude and extent of soil contamination (greater than PRGs, SSLs [with DAF of 10] or RBSLs), and groundwater contamination (greater than the State standard) in source areas have not been fully identified through proposed sampling activities, then sampling activities are not considered complete. In this case, additional sampling or information needs will be identified and discussed with DEQ/RD, and collected under a separate investigation phase if requested by DEQ/RD.</li> <li>• If proposed sampling activities indicate that COPCs are not present in potential groundwater source areas at concentrations above State standards, or if LNAPL greater than 0.1 foot in thickness is not observed, then the source area investigation is complete and further investigation is not necessary.</li> <li>• If proposed sampling activities indicate that COPCs are present in potential groundwater source areas at concentrations above State standards, or if the presence of additional areas of LNAPL greater than 0.1 foot in thickness are observed, then the source area investigation is not complete and further investigation may be necessary. In this case, additional sampling or information needs will be identified and discussed with DEQ/RD, and collected under a separate investigation phase, if requested by DEQ/RD.</li> <li>• If proposed sampling activities indicate that the extent of the smear zone has been fully characterized, then the source area investigation is complete and further investigation is not necessary.</li> <li>• If proposed sampling activities indicate that the extent of the smear zone has not been fully characterized, then the source area investigation is not complete and further investigation may be necessary. In this case, additional sampling or information needs will be identified and discussed with DEQ/RD, and collected under a separate investigation phase, if requested by DEQ/RD.</li> </ul>
<b>STEP 6: Specify Tolerable Limits on Decision Errors</b>
<ul style="list-style-type: none"> <li>• Sampling error and measurement error are associated with environmental data collection and may lead to decision errors. Sampling error occurs when the sample is not representative of the true condition of the environment at the site. Measurement error occurs because of random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. Decision errors are controlled by adopting a scientific approach which uses hypothesis testing to minimize the potential for error.</li> <li>• There are two types of decision error: false negative error, and false positive error. A false negative decision error occurs when the null hypothesis is rejected although it is true. The consequences of a false negative error would be that contaminated media posing an unacceptable risk to public health, safety, welfare or the environment at the KRY site are not remedied. A false positive decision error occurs when the null hypothesis is not rejected although it is false. The consequences of a false positive error are that unnecessary resources are expended to perform remedial action to address contaminated media that do not exist at levels exceeding action levels or acceptable risk levels.</li> <li>• Site-specific sampling objectives and the inconsistent and unknown pattern of contaminant release over time limit the usefulness of statistical methods to eliminate sampling error. Therefore, sampling locations are based on knowledge of site history, previous sampling data, and information concerning chemical use, storage, and waste disposal. Tolerable limits on sampling decision errors cannot be precisely defined; however, the decision errors will be minimized by evaluating all known and potential source areas. Decision errors based on analytical data will be minimized by the use of U.S. EPA approved analytical methods.</li> </ul>

**TABLE 3A**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF SOURCE AREAS**

<b>STEP 7: Optimize the Sampling Design</b>
<ul style="list-style-type: none"> <li>• Project measurements and DQOs have been organized into four investigation components for this SAP. However, these components are considered part of a larger and integrated site-wide investigation where an assortment of groundwater, surface water, soil, sediment and sludge samples will be collected. As such, some samples satisfy individual objectives for a single investigation component, while other samples satisfy multiple objectives for several investigation components. For the purpose of organization, all samples proposed in this SAP are organized by their corresponding investigation component and matrix type.</li> <li>• Locations selected for borings, monitoring wells, and soil samples are based on review of historical aerial photographs, previous investigative findings, and recent field reconnaissance. Therefore, all samples are located in areas that will yield representative data that are necessary to make sound decisions, and meet regulatory agency concerns and recommendations. Soil borings are located adjacent to potential sources and monitoring wells are located immediately downgradient of potential sources. Proposed sample locations are expected to provide high quality data to assess impacts to groundwater and describe contaminant migration.</li> <li>• The sampling design for soil sampling has been optimized by selecting locations for soil borings in known or suspected source areas such as ASTs, leaking drums, septic tanks, and locations where spills were observed. The sample design for groundwater sampling has been optimized by locating newly proposed monitoring wells immediately downgradient of suspected source areas to evaluate the potential for release of contaminants from soils to groundwater.</li> <li>• Analytical methods selected for both soil and groundwater analyses include methods that can detect potential contaminants of concern. Analytical methods chosen are all U.S. EPA approved and are commonly implemented. Analytical methods are discussed in Section 2.4 of this SAP.</li> </ul>



**TABLE 3B**

**DATA QUALITY OBJECTIVES  
INVESTIGATION OF NATURE, EXTENT, AND MIGRATION  
OF CONTAMINANTS OF CONCERN**

<b>STEP 1: State the Problem</b>
<p>Previous investigations at the KRY site did not fully define the extent and magnitude of site-wide COPC contamination. However, the investigations identified areas of soil that exceed PRGs, and contaminant concentrations in groundwater that exceed State standards for these COPCs, and which pose a potential threat to human health and the environment. The following problem statements are associated with investigation of the nature, extent, and migration of COPCs:</p> <ul style="list-style-type: none"> <li>• The areal extent and magnitude of site-wide groundwater contamination in the unconfined aquifer has not been fully characterized to non-detection boundaries.</li> <li>• The vertical extent and magnitude of site-wide groundwater contamination in the unconfined aquifer has not been fully characterized to non-detection boundaries.</li> <li>• The unconfined aquifer hydrogeologic system and aquifer parameters have not been fully characterized.</li> <li>• The potential for migration of COPCs from the unconfined aquifer to the deeper confined aquifer at the KRY site has not been fully assessed.</li> <li>• The interaction between groundwater and the Stillwater River has not been fully characterized.</li> <li>• The concentrations of COPCs in surface water and sediments in the Stillwater River have not been fully evaluated.</li> <li>• The areal and vertical extent of soil contamination has not been fully characterized to non-detection or background concentrations.</li> <li>• The areal extent of dioxin contamination in surface soils has not been evaluated.</li> <li>• The presence of metals, (notably chromium, cadmium and lead) and other RCRA regulated constituents in onsite refinery wastes has not been fully evaluated.</li> <li>• Additional surface soils data representative of background for soils are needed.</li> </ul>
<b>STEP 2: Identify the Decisions</b>
<ul style="list-style-type: none"> <li>• Has the areal and vertical extent of groundwater contamination in the unconfined aquifer been fully characterized to the non-detection boundary of the COPC plumes?</li> <li>• Has the site-wide hydrogeologic system (including lithology, aquifer saturated thickness, hydraulic gradient magnitude and direction, seepage velocity, recharge, existence of perched groundwater or groundwater mounds, and groundwater-surface water interactions) been described sufficiently enough to conceptualize site hydrogeology and to perform simplified flow and transport modeling to support remedial design ,if required?</li> <li>• Have site-wide variations in important aquifer parameter values (including hydraulic conductivity, transmissivity, porosity, bulk density, TOC, been sufficiently identified and quantified so that future calculations in support of remedial design can be conducted, if necessary?</li> <li>• Has it been conclusively shown that the deeper confined aquifer has not been contaminated, or that there is no downward vertical gradient from the unconfined aquifer to the deeper confined aquifer?</li> <li>• Have groundwater-surface water interactions been sufficiently described near the Stillwater River?</li> <li>• Has the nature and extent of contamination in river sediments and surface water been fully evaluated?</li> <li>• Has the horizontal and vertical extent of site-wide soil contamination been defined, particularly in areas adjacent to known soil contamination at the KPT facility, Reliance, and Yale Oil facilities?</li> <li>• Has the extent of dioxin contamination in surface soils at the KRY site been fully characterized?</li> <li>• Has refinery waste and surface and subsurface soils been shown not to contain elevated levels of RCRA regulated constituents including metals, (particularly chromium, cadmium, and lead)?</li> <li>• Have three additional samples representative of background concentrations in surface soils been collected?</li> </ul>

**TABLE 3B**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF NATURE, EXTENT, AND MIGRATION**  
**OF CONTAMINANTS OF CONCERN**

<b>STEP 3: Identify Inputs to the Decisions</b>
<ul style="list-style-type: none"> <li>• Review of previous investigative findings, sample results, and field reconnaissance completed as part of other investigations.</li> <li>• Screening criteria for groundwater and surface water contaminant concentrations that include State standards from DEQ-7. Screening criteria for soils include EPA Region 9 PRGs, SSLs (with a DAF of 10), Montana Tier 1 RBSLs, and DEQ's arsenic position paper (DEQ 2005).</li> <li>• Chemical, lithologic, and hydraulic data collected from boreholes and newly installed monitoring wells (or piezometers) proposed as part of this investigation.</li> <li>• Static water level measurements from newly installed and accessible existing monitoring wells (or piezometers) and analysis of hydraulic gradient magnitude and direction.</li> <li>• Surface water and sediment sampling results collected during previous investigations and new data collected as part of this investigation.</li> <li>• Surface soil and subsurface soil sampling results collected during previous investigations and new data collected as part of this investigation.</li> <li>• Analysis of samples of refinery waste (oils and sludges) collected during previous investigations and new data collected as part of this investigation.</li> <li>• Hydrogeologic data describing unconfined aquifer thickness and lithology, depth to the underlying clay confining unit, and vertical gradients within the unconfined aquifer.</li> <li>• Water elevation and water quality data from the confined aquifer. One monitoring well will be advanced through the clay aquitard into the underlying confined aquifer using rotosonic drilling methods.</li> <li>• Water elevation data and lithology in an area on the Reliance facility that exhibits what appears to be perched groundwater or groundwater mounding.</li> <li>• Formation- and chemical-specific data and estimates that are used to describe (1) contaminant migration including TOC, soil bulk density, organic carbon partition coefficients, retardation coefficients, obtained from this RIWP and, (2) site-specific rates of degradation and transformation obtained from onsite investigations conducted by Western Research Institute (WRI).</li> <li>• Data that indicate seasonal variations in groundwater hydrology or chemistry (such as differences in seasonal water table elevation or seasonal trends in concentrations of COPCs in groundwater).</li> <li>• Data that provide information on groundwater-surface water interactions (such as water levels and gradient directions)</li> <li>• Surface soil data from three representative background locations.</li> </ul>
<b>STEP 4: Define Study Boundaries</b>
<ul style="list-style-type: none"> <li>• The lateral extent of the study area consists of the area bounded by the north bank of the Stillwater River to the west and north, the east end of the Walmart parking lot to the east, and the southern rim of the McElroy and Wilken gravel pit to the south, although the exact boundaries cannot be determined as the extent of contamination is not known.</li> <li>• The vertical extent of the study area for soils and groundwater extends from the ground surface to the underlying confined aquifer.</li> <li>• Temporal boundaries include data collected since 1985 described in section 1.1.6 of this SAP, and extends through the period of performance of this investigation.</li> </ul>

**TABLE 3B**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF NATURE, EXTENT, AND MIGRATION**  
**OF CONTAMINANTS OF CONCERN**

**STEP 5: Develop Decision Rules**

- If the nature, extent, and migration of COPCs in the unconfined aquifer have been fully characterized through proposed sampling and analysis activities, (for example, the lateral boundary of the plumes and depth of contamination can be identified to non-detection) then sampling activities are considered complete and no further sampling will be necessary.
- If the nature, extent, and migration of COPCs in the unconfined aquifer have not been fully characterized through proposed sampling and analysis activities, (for example, the lateral boundary of the plumes and depth of contamination cannot yet be identified to non-detection), then sampling activities may not be complete and further sampling may be necessary under a separate investigation phase, if requested by DEQ/RD. In this case, additional sampling or information needs will be identified and discussed with DEQ/RD.
- If the aquifer characteristics for the unconfined aquifer (including lithology, aquifer saturated thickness, hydraulic gradient magnitude and direction, seepage velocity, aquifer stresses, recharge, and groundwater-surface water interactions) and variations in important aquifer parameter values have been fully characterized through proposed sampling and analysis activities, then sampling activities are considered complete.
- If the aquifer characteristics and aquifer parameter variations for the unconfined aquifer have not been fully characterized through proposed sampling and analysis activities, then sampling activities may not be complete, and further sampling may be necessary, if requested by DEQ/RD. In this case, additional sampling or information needs will be identified and discussed with DEQ/RD.
- If groundwater samples from the monitoring well completed in the deeper confined aquifer do not exhibit concentrations of COPCs above detection, and if the vertical gradient between the unconfined and confined aquifers has been quantified, then sampling activities are considered complete and no further sampling or measurements will be necessary.
- If groundwater samples from the monitoring well completed in the deeper confined aquifer exhibits concentrations of COPCs above detection, then sampling activities may not be complete. In this case, additional sampling needs, additional confined aquifer monitoring wells, or information needs will be identified and discussed with DEQ/RD. If the vertical gradient between the unconfined and confined aquifer has not been quantified, further measurement will be necessary.
- If water elevation data from monitoring wells and staff gages in the Stillwater River establish local gradients and flow directions to or from the river, then the groundwater-surface water interactions are considered to be defined.
- If water elevation data from monitoring wells and staff gages in the Stillwater River do not establish local gradients and flow directions to or from the river, then the definition of groundwater-surface water interactions may not be complete, and additional sampling needs or information needs will be identified and discussed with DEQ/RD.
- If the areal and vertical extent of COPCs in surface and subsurface soils have been fully characterized through proposed sampling and analysis activities, (for example the volume of contaminated soil can be identified to non-detection or background) then sampling activities are considered complete and no further sampling will be necessary.
- If the areal and vertical extent of COPCs in surface and subsurface soils have not been fully characterized through proposed sampling and analysis activities, then sampling activities may not be complete. In this case, additional sampling needs or information needs will be identified and discussed with DEQ/RD.
- If the areal extent of dioxins and furans in surface soils in residential areas has been fully characterized through proposed sampling and analysis activities (for example, background concentrations of dioxins and furans are encountered), then sampling activities are considered complete and no further sampling will be necessary.

**TABLE 3B**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF NATURE, EXTENT, AND MIGRATION**  
**OF CONTAMINANTS OF CONCERN**

**STEP 5: Develop Decision Rules (Continued)**

- If the areal extent of dioxins and furans in surface soils in residential areas has not been fully characterized through proposed sampling and analysis activities, then sampling activities may not be complete. In this case, additional sampling needs or information needs will be identified and discussed with DEQ/RD.
- If site-specific refinery waste such as oils and sludges have been characterized and shown not to contain concentrations of metals, (notably chromium, cadmium or lead) or other RCRA regulated constituents above soil PRGs (EPA 2004), SSLs (with a DAF of 10), or RCRA TCLP regulatory limits (Table 1 of 40 CFR 261.24), then onsite refinery wastes have been shown not to contain these metals through proposed sampling and analysis activities, and site-wide analysis of soils for these metals and other RCRA regulated constituents is not necessary.
- If site-specific refinery waste such as oils and sludges have been characterized and shown to contain concentrations of metals or other RCRA regulated constituents above soil PRGs (EPA 2004), SSLs (with a DAF of 10), or RCRA TCLP regulatory limits (Table 1 of 40 CFR 261.24), then further site-wide analysis of these refinery wastes may be warranted. In this case, additional sampling needs or information needs will be identified and discussed with DEQ/RD.
- If contamination in river sediments or surface water is not present at concentrations above screening levels, then sampling activities are considered complete and no further sampling will be necessary. DEQ's VCRA Guide recommends comparison of sediment concentrations to Washington State Department of Ecology Freshwater Sediment Quality Values (Washington State 1997) or U.S. Department of Energy (DOE) Preliminary Remediation Goals for Ecological Endpoints (DOE 1995 and 1997).
- If contamination in river sediments or surface water is present above screening levels, then sampling activities may not be complete and the need for further sampling will be discussed with DEQ/RD.
- If three surface soil samples representative of background have been collected, then sampling activities to establish background for soils are complete. Representative background soil sample locations will be based on review of aerial photographs and current site conditions to select natural, undisturbed, or non-industrialized areas such as parks or naturally timbered areas. All proposed background locations must first be approved by DEQ/RD prior to sampling. The proposed maximum number of background soil samples (3) was determined by DEQ/RD.
- If three surface soil samples representative of background have not been collected, then sampling activities to establish background for soils are not complete.

**TABLE 3B**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION OF NATURE, EXTENT, AND MIGRATION**  
**OF CONTAMINANTS OF CONCERN**

<b>STEP 6: Specify Tolerable Limits on Decision Errors</b>
<ul style="list-style-type: none"> <li>• Sampling error and measurement error are associated with environmental data collection and may lead to decision errors. Sampling error occurs when the sample is not representative of the true condition of the environment at the site. Measurement error occurs because of random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. Decision errors are controlled by adopting a scientific approach which uses hypothesis testing to minimize the potential for error.</li> <li>• There are two types of decision error: false negative error, and false positive error. A false negative decision error occurs when the null hypothesis is rejected although it is true. The consequences of a false negative error would be that contaminated media that pose an unacceptable risk to public health, safety, welfare or to the environment at the KRY site are not remedied. A false positive decision error occurs when the null hypothesis is not rejected although it is false. The consequences of a false positive error are that unnecessary resources are expended to perform remedial action to address contaminated media that do not exist at levels exceeding action levels or acceptable risk levels.</li> <li>• Limits on decision errors due to measurement error can be addressed using statistical methods. However, site-specific sampling objectives and the inconsistent and unknown pattern of contaminant release over time limit the usefulness of statistical methods to eliminate sampling error. Therefore, sampling locations are based on knowledge of site history and information concerning chemical use, storage, and waste disposal. Tolerable limits on sampling decision errors cannot be precisely defined; however, the decision errors will be minimized by evaluating all known and potential source areas. Decision errors based on analytical data will be minimized by the use of U.S. EPA approved analytical methods.</li> </ul>
<b>STEP 7: Optimize the Sampling Design</b>
<ul style="list-style-type: none"> <li>• Project measurements and DQOs have been organized into four logical investigation components for this SAP. However, these components are considered part of a larger and integrated site-wide investigation where an assortment of groundwater, surface water, soil, and sediment samples will be collected. As such, some samples satisfy individual objectives for a single investigation component, while other samples satisfy multiple objectives for several investigation components. For the purpose of organization, all samples proposed in this SAP are organized by their corresponding investigation component and matrix type.</li> <li>• Locations selected for boreholes, monitoring wells, and surface water samples are based on review of historical aerial photographs, previous investigative findings, recent field reconnaissance, and discussion with DEQ/RD. Therefore, all samples will be located in areas that will yield representative data that are necessary to make sound decisions and meet regulatory agency concerns and recommendations. Proposed sample locations will provide high quality data to describe contaminant migration.</li> <li>• Analytical methods selected for both soil and groundwater analyses include methods that can detect potential contaminants of concern. Analytical methods chosen are all U.S. EPA or DEQ, approved and are commonly implemented.</li> </ul>

**TABLE 3C**

**DATA QUALITY OBJECTIVES  
INVESTIGATION TO SUPPORT RISK CHARACTERIZATION**

**STEP 1: State the Problem**

Previous investigations at the KRY site have indicated that there have been releases of COPCs including PCP, PAHs, dioxins and furans and petroleum hydrocarbons. Previous investigations have identified elevated concentrations of COPCs in site soil and groundwater that exceed State standards and pose a potential threat to human health and the environment. These soil and groundwater impacts have not been fully characterized. The following are problem statements associated with the investigation to fulfill additional data needs for use in risk characterization:

- Given that the extent and magnitude of contamination requires further characterization at the KRY site, characterization of representative concentrations in surface soil (0 to 2 ft bgs), for source and non-source area soils is needed. In addition, subsurface soil (2 to 10 ft bgs) for source and non-source area soils must be characterized. Source area and non-source area surface soil (0 to 2 ft bgs) needs to be characterized where there is a complete exposure pathway for terrestrial receptors, or where runoff to ecological habitat is possible. (Note that the 0 to 2 ft bgs depth interval, by definition, is considered surface soil; however, for this investigation the majority of surface soil samples will be collected within the 0 to 0.5 ft depth interval within the facility boundary and 0 to 2 inch depth interval outside the facility boundary. Also note that for this SAP, “source areas” include the immediate area in the vicinity of the former treating vats at the KPT facility, and the waste oil and fenced off sludge areas associated with the Reliance facility. “Non-source areas” include the remaining area within the “approximate facility boundary.” The surface soil depth interval will include human health exposure to the current industrial worker, future residential, and future recreational/trespasser scenarios; the subsurface soil depth interval include human health exposure to the utility/construction worker who, while constructing or repairing subsurface utilities, may contact contaminated subsurface soils. To ensure brevity, this information will not be repeated each time soil is referenced.
- Given that the extent and magnitude of contamination of subsurface soil requires further characterization, characterization of groundwater concentrations is required to evaluate potential (short-term) utility/construction exposure during construction or repair of subsurface utilities. Exposure to groundwater by utility/construction workers will be considered complete when the depth to groundwater is near or less than 10 ft bgs, which is the deepest depth that routine construction activities occur. (A quantitative risk assessment will be conducted only for constituents not identified in DEQ-7). For other constituents in groundwater, State standards (DEQ-7) must be met.
- Representative surface water concentrations in the Stillwater River are needed for both the HHRA (recreational [trespasser/visitor] scenario only) and the screening level ecological risk assessment (SLERA).
- Characterization of sediment (given the possibility for contaminant loading at the groundwater/surface water interface) in the Stillwater River is needed. At this time, field reconnaissance indicates sufficient substrate for sediment-dwelling organisms in the river. Therefore, representative sediment concentrations in the river are needed for both the HHRA (recreational/trespasser scenario only) and the SLERA.
- For the HHRA, characterization of representative concentrations of selected COPCs in groundwater (only for constituents not identified in DEQ-7) is needed on an appropriate spatial and temporal scale (for the residential, industrial, and utility/construction worker scenarios). For other constituents in groundwater, State standards (DEQ-7) must be met. For the SLERA, representative concentrations of COPCs in groundwater which may migrate to surface water in the Stillwater River are needed.

**TABLE 3C**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION TO SUPPORT RISK CHARACTERIZATION**

<b>STEP 2: Identify the Decisions</b>
<ul style="list-style-type: none"> <li>• Have enough samples for selected COPCs from surface soil (0 to 2 ft bgs) and groundwater (only for constituents not identified in DEQ-7) been collected in source and non-source areas and analyzed for use in the HHRA and SLERA?</li> <li>• Have enough samples from subsurface soil (2 to 10 ft bgs) been collected in source and non-source areas for use in the HHRA?</li> <li>• Where groundwater is reasonably expected to discharge to the Stillwater River, or where there is a high potential for erosion and transport of soil from on site, have enough samples of sediment (0 to 0.5 ft) and surface water been analyzed to characterize ecological and human recreational exposures?</li> <li>• Have representative concentrations in groundwater been compiled on an appropriate spatial and temporal scale?</li> </ul>
<b>STEP 3: Identify Inputs to the Decisions</b>
<ul style="list-style-type: none"> <li>• Previous investigative findings and data collected during this investigation establishing COPC concentrations detected in soil near source areas (to evaluate data for usability in the risk assessment).</li> <li>• Previous investigative findings and data collected during this investigation from soils outside known source areas establishing COPC concentrations detected in soil (to evaluate existing data for usability in the risk assessment).</li> <li>• Hydrological information from this investigation determining to what extent groundwater interacts with the Stillwater River; and the extent to which erosion and migration of site soils to the river may occur. In addition, information that addresses other nonsite related sources which may impact river sediments.</li> <li>• Site-specific information regarding an appropriate SLERA food web for evaluation in both terrestrial and aquatic (wetland/ditch/river) areas near the KRY site, including (1) whether, or in what portions of the site, habitat is available for ecological species, (2) whether any sensitive (threatened/endangered/special status) species access the KRY site, and (3) whether the river contains habitat for sediment-dwelling organisms.</li> <li>• Site-specific information regarding appropriate HHRA scenario assumptions for constituents not identified in DEQ-7. Site-specific information is needed to finalize assumptions for the groundwater use scenarios (for example, whether current groundwater use is limited to irrigation for those residents who reported irrigation-only uses, or whether future ingestion use of all wells should be considered). For groundwater constituents identified in DEQ-7, State standards (DEQ-7) must be met.</li> </ul>

**TABLE 3C**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION TO SUPPORT RISK CHARACTERIZATION**

**STEP 4: Define Study Boundaries**

- The lateral extent of the study area consists of the area bounded by the north bank of the Stillwater River to the west and north, the east end of the Walmart parking lot to the east, and the southern rim of the McElroy and Wilken gravel pit to the south, although the exact boundaries cannot be determined as the extent of contamination is not known. In addition, 3 surface soil samples will be collected outside of this defined study area for characterizing background concentrations in soils. Eleven residential surface soil samples (0 to 2 inches) will be collected in residential areas to the south, west, north and east of the facility boundaries. (Note that the 0 to 2 ft bgs depth interval, by definition, is considered surface soil; however, for this investigation the majority of surface soil samples will be collected within the 0 to 2 inch or 0 to 0.5 ft depth intervals.)
- The vertical extent of the study area for surface soil is 0 to 2 ft bgs for the HHRA. Lateral extent of the surface soil investigation includes operational areas where exposure is expected to occur on KPT, Reliance, and Yale Oil facilities, as well as residential areas immediately adjacent to the three facilities.
- The vertical boundary for the study area for subsurface soils is 2 to 10 ft bgs for the HHRA. Lateral extent of the subsurface soil investigation includes areas near existing or possible non-source area utility/construction corridors that could reasonably be anticipated to require maintenance.
- For evaluation of soil-related ecological risks, SLERA scenarios will be assessed for future ecological use from ground surface to 2.0 ft bgs, which in general will be the vertical boundary for ecological samples; however, deeper subsurface soil intervals (4 to 6 ft bgs and 8 to 10 ft bgs) may need to be considered to address issues related to tree roots and burrowing animals. In this case, the vertical boundary for ecological samples will be extended to the appropriate depth interval. The lateral boundaries for SLERA study areas include the non-source area terrestrial habitats in the vicinity of the Stillwater River.
- For residential and industrial scenarios, the vertical extent for all groundwater exposure assessments (only for constituents not identified in DEQ-7) includes the sand and gravel unconfined aquifer within the KRY site and vicinity. The vertical extent for the utility/construction scenario is 10 ft bgs as described above.
- The study area for sediment in the Stillwater River includes a vertical extent for surface sediments to 0.5 ft bgs for both recreational HHRA scenarios and SLERA exposures. The lateral extent of the study area for sediment and surface water includes the river where either human recreational or ecological activity has been observed or influenced by site related activities.
- Temporal boundaries include validated, representative data (provided they meet the usability criteria for risk assessment established by EPA) collected since 1985 (described in the KRY data summary report), extending through the period of performance of this investigation (for current exposure scenarios). If appropriate, separate “future use” concentrations may be projected, subsequent to the evaluation of groundwater conditions and trend analysis (that is, are steady-state or declining concentration conditions observed such that “current” scenarios will be protective of “future” use scenarios).



**TABLE 3C**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION TO SUPPORT RISK CHARACTERIZATION**

**STEP 5: Develop Decision Rules**

- If sufficient soil and groundwater sampling has been conducted to characterize representative and is sufficient for the HHRA and SLERA through proposed sampling activities, then sampling activities are considered complete and no further sampling will be necessary.
- If sufficient soil and groundwater sampling has not been conducted to characterize representative and is sufficient for the HHRA and SLERA through proposed sampling activities, then sampling activities are not considered complete, and further sampling may be necessary, if requested by DEQ/RD.
- If sufficient surface water and sediment sampling has been conducted to characterize representative concentrations in appropriate locations (specifically, the Stillwater River) and is sufficient for the HHRA and SLERA through proposed sampling activities, then further characterization of surface water and sediment is not required.
- If sufficient surface water and sediment sampling has not been conducted to characterize representative concentrations in appropriate locations (specifically, the Stillwater River) and is sufficient for the HHRA and SLERA through proposed sampling activities, then characterization of surface water and sediment concentrations may be required, if requested by DEQ/RD.

**STEP 6: Specify Tolerable Limits on Decision Errors**

Although site-specific sampling objectives and the inconsistent and unknown pattern of contaminant release over time limit the usefulness of statistical methods in selecting sampling locations for the site-wide investigation, statistical approaches will be used on a smaller scale where possible, as follows:

- For the soil investigations, investigation methods should be as statistically based as possible given the multiple and sometimes competing goals (that is, source area delineation versus statistical/grid sampling) of the investigations. Specifically, six or more “random” (grid) samples should be considered for each exposure area (KPT, Reliance, and Yale Oil facilities) at each relevant depth to be included in the assessment to statistically and spatially characterize the exposures expected for a chronic scenario. At the KPT facility, a minimum of six samples should be collected in the principal source area (near the former treating vats and excavation) and six samples should be collected in areas further from the source that may exhibit contamination near the unsaturated zone-groundwater interface. The tolerable limits on the decision errors are established as 0.05 for both false rejection (that is, 95 percent sure that the true mean will not be determined to be below the soil PRG when it was truly above the soil PRG) and false acceptance. Note, that more than six samples may be collected, however six samples is the minimum number required by the risk assessor for a statistically valid analysis.
- For the groundwater investigation, up to four quarterly samples should be collected from each point of exposure (where a “point of exposure” is an individual well) over time to provide a reasonable characterization of the concentration at each exposure point.
- No specific tolerable limits on the decision errors will be established for surface water or sediment, because such samples will be judgmental (non-random) samples, such that the random sampling design assumptions are not met.
- Decision errors based on analytical data will be minimized by the use of U.S. EPA-approved analytical methods and quality assurance/quality control sampling. Validated data will adhere to strict precision and accuracy measures. An important aspect of this investigation is to generate the highest quality data with reporting limits that are less than risk based criteria to assure that non-detect concentrations do not pose a level of unacceptable risk. For some analytes such as arsenic and tetraethyl lead, this is not possible because the lowest reporting limits using the best analytical methods still pose an unacceptable risk.

**TABLE 3C**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION TO SUPPORT RISK CHARACTERIZATION**

<b>STEP 7: Optimize the Sampling Design</b>
<ul style="list-style-type: none"> <li>• Locations of selected monitoring wells and soil samples are based on strategic review of previous investigative findings, planned nature and extent sampling (see Tables 3A) and discussion with DEQ/RD.</li> <li>• Analytical methods that can detect potential contaminants of concern at concentrations below PRGs and State standards have been selected for both soil and groundwater analyses, where possible. All analytical methods used will be U.S. EPA-approved methods with project-required detection limits that will be less than PRGs and State standards (to the extent feasibly possible based on field conditions and interfering compounds).</li> <li>• Soil sampling design will be collected randomly from a standardized 50 foot by 50 foot grid pattern (with random samples) set forth in this SAP and may overlap samples collected to determine nature and extent of contamination (Table 3A). Note that not all 50 foot by 50 foot grid nodes will be sampled, but random samples will be collected from the grid nodes.</li> <li>• Three onsite surface water and sediment stations located along the Stillwater River will be used to evaluate surface water and sediment (0 to 0.5 ft bgs) risks in the HHRA and SLERA. In addition, an upstream control station and a station located downstream from the site will be sampled.</li> </ul>

**TABLE 3D**

**DATA QUALITY OBJECTIVES**

**INVESTIGATION TO SUPPORT EVALUATION OF REMEDIAL ALTERNATIVES**

<b>STEP 1: State the Problem</b>
<p>Previous investigations at the KRY site identified elevated concentrations of COPCs in soils and concentrations of COPCs in groundwater that exceed state and federal standards, and thus pose a potential threat to human health and the environment. Alternatives for remediating site contamination will be evaluated in a feasibility study. The following are problem statements associated with investigation data needs for assessing remedial alternatives:</p> <ul style="list-style-type: none"> <li>• Groundwater, surface water, sediment, and soils require additional characterization to evaluate the applicability of remediation technologies at the site. Additional characterization for soil includes analyses for moisture content, grain size analyses, pH, (in addition to porosity, bulk density, and TOC collected as part of the nature and extent investigation). Lastly, MNA parameters will be collected by WRI.</li> <li>• Groundwater contaminated by PCP is currently being treated by in situ chemical oxidation (ozonation system), however the effectiveness of the existing system to reduce PCP concentrations in groundwater is unknown. It is also unknown if the existing system creates toxic byproducts in groundwater such as bromate, aldehydes, or ketones.</li> </ul>
<b>STEP 2: Identify the Decisions</b>
<ul style="list-style-type: none"> <li>• After fully satisfying the DQOs for (1) source area investigation, (2) the nature, extent, and migration of COPCs investigations, and (3) human health and ecological risk investigations, have a sufficient number of groundwater, surface water, sediment, and soil samples been collected at a sufficient number of locations to provide data to assess likely remedial alternatives?</li> <li>• Have the appropriate laboratory analyses been performed on the samples that have been collected so that likely remedial alternatives can be assessed?</li> <li>• Have the appropriate laboratory analyses been performed on the samples that have been collected so that the effectiveness of the existing ozonation system can be assessed?</li> </ul>
<b>STEP 3: Identify Inputs to the Decisions</b>
<ul style="list-style-type: none"> <li>• Review of previous investigative findings and sampling.</li> <li>• Results of sampling proposed as part of this investigation to investigate, characterize, or assess (1) source areas, (2) nature, extent and migration of COPCs, and (3) human health and environmental risks.</li> <li>• Remedial action objectives consisting of media-specific or area-specific goals for protecting human health and the environment.</li> <li>• A complete description of exposure routes and receptors, as well as an acceptable contaminant concentration for each exposure route.</li> <li>• The list of likely potential remedial action alternatives for soil, LNAPL and water</li> <li>• Additional sample locations, analyses, and bench scale testing that may be necessary (for example, in the case of biodegradation of PCP and TPH this could include analyses for dissolved oxygen, chloride, sulfate, sulfide, iron, nitrogen, phosphorus, methane, formaldehyde, acetone and bromate). Additional analyses may be required by WRI based on their currently ongoing investigation of the potential for bioremediation.</li> </ul>
<b>STEP 4: Define Study Boundaries</b>
<ul style="list-style-type: none"> <li>• The lateral extent of the study area consists of the area bounded by the north bank of the Stillwater River to the west and north, the east end of the Walmart parking lot to the east, and the southern rim of the McElroy and Wilken gravel pit to the south, although the exact boundaries cannot be determined as the extent of contamination is not known.</li> <li>• The vertical extent of the study area for soils will extend from the ground surface, through the sand and gravel aquifer, to the top of the underlying clay unit. The study area for groundwater primarily includes the unconfined sand and gravel aquifer.</li> <li>• Temporal boundaries include data collected since 1985 described in section 1.1.6 of this SAP, and extends through the period of performance of this investigation.</li> </ul>

**TABLE 3D**  
**(Continued)**  
**DATA QUALITY OBJECTIVES**  
**INVESTIGATION TO SUPPORT EVALUATION OF REMEDIAL ALTERNATIVES**

<b>STEP 5: Develop Decision Rules</b>
<ul style="list-style-type: none"> <li>• If other investigation DQOs are met and an appropriate number of samples have been collected and analyzed so that likely remedial alternatives (and ongoing ozonation) can be fully assessed, sampling and analysis activities are considered complete and no further sampling or analyses will be necessary.</li> <li>• If other investigation DQOs are not met or an appropriate number of samples have not been collected or analyzed so that remedial alternatives (and ongoing ozonation) can be fully assessed, sampling and analysis activities are not considered complete and further sampling or analyses may be necessary, if requested by DEQ/RD. In this case, additional sampling or analysis needs will be identified and discussed with DEQ/RD.</li> </ul>
<b>STEP 6: Specify Tolerable Limits on Decision Errors</b>
<ul style="list-style-type: none"> <li>• Sampling error and measurement error are associated with environmental data collection and may lead to decision errors. Sampling error occurs when the sample is not representative of the true condition of the environment at the site. Measurement error occurs because of random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. Decision errors are controlled by adopting a scientific approach which uses hypothesis testing to minimize the potential for error.</li> <li>• There are two types of decision error: false negative error, and false positive error. A false negative decision error occurs when the null hypothesis is rejected although it is true. The consequences of a false negative error are that contaminated media at the KRY site are not remedied. A false positive decision error occurs when the null hypothesis is not rejected although it is false. The consequences of a false positive error are that unnecessary resources are expended to perform remedial action to address contaminated media that do not exist at levels exceeding action levels or acceptable risk levels.</li> <li>• Limits on decision errors due to measurement error can be addressed using statistical methods. However, site-specific sampling objectives at the KRY site and the inconsistent and unknown pattern of contaminant release over time limit the usefulness of statistical methods to eliminate sampling error. Therefore, sampling locations are based on knowledge of site history and information concerning chemical use, storage, and waste disposal. Tolerable limits on sampling decision errors cannot be precisely defined; however, the decision errors will be minimized by evaluating all known and potential source areas.</li> <li>• Decision errors based on analytical data will be minimized by the use of U.S. EPA approved analytical methods.</li> </ul>
<b>STEP 7: Optimize the Sampling Design</b>
<ul style="list-style-type: none"> <li>• Project measurements and DQOs have been organized into four logical investigation components for this SAP. However, these components are considered part of a larger and integrated site-wide investigation where an assortment of groundwater, surface water, soil, and sediment samples will be collected. As such, some samples satisfy individual objectives for a single investigation component, while other samples satisfy multiple objectives for several investigation components. For the purpose of organization, all samples proposed in this SAP are organized by their corresponding investigation component and matrix type.</li> <li>• Locations selected for borings, monitoring wells, and soil samples are based on review of historical aerial photographs, previous investigative findings, recent field reconnaissance, and discussion with DEQ/RD. Therefore, samples will be located in areas that will yield representative data that are necessary to make sound decisions, and meet regulatory agency concerns and recommendations. Proposed sample locations will provide high quality data to evaluate remedial alternatives.</li> <li>• Analytical methods selected for both soil and groundwater analyses include methods that can detect potential contaminants of concern, and assist in the evaluation of remedial alternatives. Analytical methods chosen are all U.S. EPA approved and are commonly implemented.</li> </ul>

Note that some samples collected as part of this SAP will satisfy only an individual DQO for a specific investigation, while other samples will satisfy multiple DQOs outlined in several investigations. A summary of proposed samples is presented in Appendix F, Table F-1. This summary indicates the DQOs that relate to each sample proposed in this SAP.

### **1.3.2 Project Measurements**

This SAP proposes that liquid and solid matrix samples will be analyzed for identified COPCs and other parameters of interest as identified in Section 2.4 of this SAP. Additional details related to sample collection and method analyses are provided in Sections 2.1 and Section 2.4, respectively. Station locations, sample types, and rationale for sampling are provided in Appendix F. Project measurements are summarized below. Details related to each proposed sample, as well as to sampling methodology are provided in Section 2.0 of this SAP.

Groundwater samples will be collected from newly proposed monitoring wells, existing onsite monitoring wells, and both industrial and residential water supply wells. Static water level measurements will be collected from newly proposed and existing monitoring wells, and an interface probe will be used to measure LNAPL thicknesses greater than 0.1 ft, if encountered. Static water levels will be measured in industrial and residential wells if there is access to the well. Analysis of groundwater samples will include all identified COPCs and other parameters of interest to evaluate the potential for impacts to groundwater posed from known sources and potential sources of contamination in KRY site areas. Groundwater quality and hydraulic data will be used (1) to refine current estimates of contaminant flow and contaminant migration across the KRY site, (2) to identify sources of groundwater contamination, and (3) to further assess human health and environmental risks. Risks will not be calculated for groundwater constituents identified in DEQ-7. Instead, groundwater quality must meet State standards (DEQ-7).

Five surface water and five stream bed sediment samples will be collected at newly proposed monitoring stations along the Stillwater River. River stage at each station will be measured at a permanently fixed staff gage to evaluate the movement of groundwater near the river.

Soil samples will be collected from selected monitoring well borings, soil borings, and surface soil stations. These data will be used to define the areal and vertical extent of contaminated soils at known source locations, assess the potential for contamination in the smear zone, and to characterize soils from the 0 to 10 foot bgs depth intervals for risk assessment purposes.

Solid and liquid matrix samples will also be collected and analyzed for characterization of investigation derived waste (IDW). IDW analyses will include dioxins and furans, VOCs, SVOCs including PAHs, chlorinated and non-chlorinated pesticides, chlorinated herbicides, pH, ignitability, reactivity, and metals for characterization. Solid and liquid matrix IDW samples will be shipped to an offsite laboratory (Energy Laboratories, Inc. located in Helena, Montana or Pace Analytical, located in Minneapolis, Minnesota, as appropriate).

Details related to aspects of data generation and acquisition, including an in-depth description of the sampling process design and sampling methods for the KRY site, are presented in Section 2.0 of this SAP.

### 1.3.3 Project Quality Assurance Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to ensure the attainment of project specific DQOs. Of these PARCC parameters, precision and accuracy will be evaluated quantitatively through the collection of the quality control (QC) samples listed in Table 4. Precision and accuracy goals for these QC samples are listed in Appendix A.

**TABLE 4**  
**QUALITY CONTROL SAMPLES FOR PRECISION AND ACCURACY**

QC Type	Precision	Accuracy	Frequency
Field QC	Field duplicate RPD (Solid Matrix Only)	Source Water Blanks Equipment Rinsate Blanks Trip Blanks (VOC only)	Field Duplicate = 1 per 20 samples Source Water Blank = 1 per 20 samples Equipment Rinsate = 1 per 20 samples Trip Blanks = 1 per 20 VOC samples
Laboratory QC	MS/MSD RPD Field Duplicate RPD	MS/MSD %R Method Blanks LCS or Blank Spikes Surrogate Standards %R Internal Standards %R	MS/MSD = 1 per 20 samples (soil/water) Method Blank = 1 per 20 samples LCS or Blank Spikes = 1 per 20 samples every sample every sample Field duplicate = 1 per 20 samples (water)

Notes:

%R      Percent recovery

QC      Quality control

VOC      Volatile organic compound

LCS

RPD

MS/MSD

Laboratory control sample

Relative percent difference

Matrix spike/matrix spike duplicate

The subsections below discuss in detail the objectives relating to each of the PARCC parameters.

#### **1.3.3.1 Precision**

Precision is the degree of mutual agreement between individual measurements of the same property under similar conditions. Combined field and laboratory precision is evaluated by collecting and analyzing field duplicates and then calculating the variance between the samples, typically as a relative percent difference (RPD).

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100$$

where:     A = first duplicate concentration  
              B = second duplicate concentration

For this project, field duplicates will be collected for liquid matrix samples. Although field duplicate samples for solid matrix samples are sometimes collected from adjacent locations, such solid matrix duplicate samples will not be collected for this project for two reasons. First, since adjacent soil borings or adjacent soil samples incorporate some spatial variability, these samples cannot be used directly to assess sampling precision. Secondly, it is not practical to set QC limits for the RPD of such samples, which precludes the use of these samples for QC purposes.

Laboratory analytical precision is evaluated by analyzing matrix spikes (MS) and matrix spike duplicates (MSD). For this project, MS/MSD samples will be generated for all analyses of soil and water samples. The results of the analysis of each MS/MSD pair will be used to calculate an RPD for evaluating precision.

#### **1.3.3.2 Accuracy**

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. The accuracy of a measurement system can be affected by errors introduced by field contamination, sample preservation, sample handling, sample preparation, and analytical techniques. A program of sample spiking will be conducted to evaluate laboratory accuracy. This program includes analysis of the MS and MSD samples, laboratory control spikes (LCS) or blank spikes, surrogate standards, and method blanks. MS and MSD samples will be prepared and analyzed at a frequency of 5 percent for soil and water samples. LCS or blank spikes are also analyzed at a frequency of 5 percent.

Surrogate standards, where available, are added to every sample analyzed for organic constituents. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy.

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where      S = Measured spike sample concentration  
              C = Sample concentration  
              T = True or actual concentration of the spike

Appendix A presents accuracy goals for this investigation based on the percent recovery of matrix and surrogate spikes. Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

#### **1.3.3.3 Representativeness**

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through established field and laboratory procedures and their consistent application. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

#### **1.3.3.4 Completeness**

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation. The completeness goal for



this project is 100 percent for all residential well, residential soil, and surface water and sediment samples. The completeness goal for all other sample types is 90 percent.

#### **1.3.3.5 Comparability**

Comparability expresses the confidence with which one data set can be compared with another.

Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Analytical methods selected for the KRY site SAP will be only DEQ-approved methods.

#### **1.3.3.6 Detection and Quantitation Limits**

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a given sample matrix. PRRLs for this SAP are specified maximum quantitation limits for each analyte that would ensure that all screening criteria can be evaluated.

Appendix D (Tables D-2 and D-3) contains a comparison of the PRRLs and laboratory required reporting limits (LRRL); (that is, the practical quantitation limits), for the selected analytical methods in comparison to applicable regulatory screening criteria. The purpose of this comparison is to show that the selected analytical methods, and associated LRRLs, are capable of quantifying contaminants of concern at or below the applicable screening level. In comparing the LRRLs to PRRLs, however, it is important to note that actual laboratory quantitation limits may be lower than LRRLs and that estimates of analyte concentrations down to MDLs can typically be provided in order to allow comparisons to PRRLs that are below LRRLs.

For this project, results of laboratory analyses will be reported as estimated values if concentrations are less than LRRLs but greater than MDLs. The MDL for each analyte will be listed as the detection limit in the laboratory's electronic data deliverable (EDD). This procedure is being adopted to help ensure that effective comparisons of analyte results to PRGs can be performed for certain compounds where the LRRL is near or below the PRG and to ensure that subsequent statistical evaluations of the data will not be biased by high-value nondetect results. Tables presented in Appendix D indicate that most LRRLs are

below the screening criteria proposed for the KRY site as part of this RI. Where LRRLs are higher than PRRLs, the laboratory will be contacted to ensure that the lowest detection limit possible is reported.

## **1.4 PROJECT ORGANIZATION AND SUBCONTRACTORS**

Table 5 presents the responsibilities and contact information for key personnel involved in the KRY site RI. In some cases, more than one responsibility has been assigned to a person. Figure 4 presents the organization of the project team.

### **1.4.1 Subcontractors**

TTEMI will only use subcontractors that have been approved by DEQ/RD if subcontracted services are required to implement this SAP. TTEMI will use DEQ/RD guidance for the procurement of subcontractors for RI tasks requiring the use of subcontractors. TTEMI will evaluate the available subcontractors and their qualifications and prepare the Request for Bid (RFB) documents. The solicitation will require a minimum of three qualified subcontractor bids. RFB documentation will be submitted to DEQ/RD for approval. Subcontractors must be approved by DEQ/RD prior to performing services and DEQ/RD will provide TTEMI with written approval.

Energy Laboratories, Inc., located in either Billings, Montana or Helena, Montana will likely continue to be retained by DEQ/RD to complete Level III laboratory analyses for the majority of solid and liquid matrix samples collected as specified in this SAP. In addition, Pace Analytical, located in Minneapolis, Minnesota will be retained to complete specialized analyses required for low level detection limits for dioxins and furans. Energy Laboratories, Inc. will contract directly with DEQ/RD; therefore, no subcontract agreement with TTEMI is necessary.

Subcontractors to provide specialized laboratory services, drilling, excavation services, utility locators, surveying, equipment supplier(s), and other necessary support services will need to be identified and will be retained following DEQ/RD approval.

**TABLE 5**  
**PROJECT PERSONNEL**

<b>Name</b>	<b>Organization</b>	<b>Role</b>	<b>Responsibilities</b>	<b>Contact Information</b>
Moriah Bucy	DEQ/RD	State project officer	<ul style="list-style-type: none"> <li>• Monitors performance of the contractor</li> <li>• Reviews and approves QA measures</li> <li>• Reviews and approves all SAPs (FSP/QAPP)</li> <li>• Community Relations</li> </ul>	Montana Department of Environmental Quality P.O. Box 200901 Helena, MT 59620-0901 mbucy@mt.gov (406) 444-0497
Brian Antonioli	TTEMI	Project manager/ Field team Leader (1 of 3)	<ul style="list-style-type: none"> <li>• Responsible for implementing all activities called out in Task Order</li> <li>• Supervises preparation of SAP and approves document</li> <li>• Monitors and directs field activities to ensure compliance with SAP requirements</li> <li>• Provides coordination with DEQ Project Officer</li> <li>• Responsible for directing day-to-day field activities conducted by TTEMI and subcontractor personnel</li> <li>• Verifies that field sampling and measurement procedures follow SAP</li> </ul>	TTEMI, Helena, MT 7 West 6 <sup>th</sup> Avenue Helena, MT 59601 Brian.Antonioli@ttemi.com (406) 442-5588
Dave Donohue	TTEMI	Field team leader (1 of 3)	<ul style="list-style-type: none"> <li>• Responsible for directing day-to-day field activities conducted by TTEMI and subcontractor personnel</li> <li>• Verifies that field sampling and measurement procedures follow SAP</li> <li>• Provides project manager with regular reports on status of field activities</li> </ul>	TTEMI, Helena, MT 7 West 6 <sup>th</sup> Avenue Helena, MT 59601 David.Donohue@ttemi.com (406) 442-5588
Randy Laskowski	TTEMI	Field team leader (1 of 3)	<ul style="list-style-type: none"> <li>• Responsible for directing day-to-day field activities conducted by TTEMI and subcontractor personnel</li> <li>• Verifies that field sampling and measurement procedures follow SAP</li> <li>• Provides project manager with regular reports on status of field activities</li> </ul>	TTEMI, Helena, MT 7 West 6 <sup>th</sup> Avenue Helena, MT 59601 Randy.Laskowski@ttemi.com (406) 442-5588
Dan Shaffer	TTEMI	Onsite safety officer	<ul style="list-style-type: none"> <li>• Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels</li> <li>• Conducts safety briefings for TTEMI and subcontractor personnel and site visitors</li> <li>• Can suspend operations that threaten health and safety</li> </ul>	TTEMI, Helena, MT 7 West 6 <sup>th</sup> Avenue Helena, MT 59601 Daniel.Shaffer@ttemi.com (406) 442-5588

**TABLE 5 (Continued)**  
**PROJECT PERSONNEL**

<b>Name</b>	<b>Organization</b>	<b>Role</b>	<b>Responsibilities</b>	<b>Contact Information</b>
Candy Friday	TTEMI	Analytical coordinator	<ul style="list-style-type: none"> <li>Responsible for working with project team to define analytical requirements</li> <li>Assists in the arrangements with laboratories (see Section 2.4 of SAP)</li> <li>Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics</li> <li>Reviews laboratory data before release to project team</li> </ul>	TTEMI, Houston, TX Regency Center 2901 Wilcrest Drive Houston, TX 77042 <a href="mailto:Candy.Friday@ttemi.com">Candy.Friday@ttemi.com</a> 832-251-5166
Veronica O'Neill	TTEMI	Database manager	<ul style="list-style-type: none"> <li>Responsible for developing, monitoring, and maintaining project database under guidance of project manager</li> <li>Works with analytical coordinator during SAP preparation to resolve sample identification issues</li> </ul>	TTEMI, San Francisco, CA 135 Main Street Suite 1800 San Francisco, CA 94105 <a href="mailto:Veronica.Oneill@ttemi.com">Veronica.Oneill@ttemi.com</a> (415)-222-8256
Bill Brown	Energy Laboratories, Inc.	Project Manager	<ul style="list-style-type: none"> <li>Responsible for delivering analytical services that meet SAP requirements</li> <li>Reviews SAP to understand analytical requirements</li> <li>Works with TTEMI analytical coordinator to confirm sample delivery schedules</li> <li>Reviews laboratory data package before delivery to TTEMI</li> </ul>	Energy Laboratories, Inc. P.O. Box 30916 Billings, MT 59107 <a href="mailto:bbrown@enrgylab.com">bbrown@enrgylab.com</a> (406) 252-6325 or 1-800-735-4489
Scott Unze	Pace Analytical	Technical Contact	<ul style="list-style-type: none"> <li>Responsible for delivering analytical services that meet SAP requirements</li> <li>Reviews SAP to understand analytical requirements</li> <li>Works with TTEMI analytical coordinator to confirm sample delivery schedules</li> <li>Reviews laboratory data package before delivery to TTEMI</li> </ul>	Pace Analytical 1700 Elm Street, Suite 200 Minneapolis, MN 55414 1-612-607-6383 <a href="mailto:Scott.Unze@pacelabs.com">Scott.Unze@pacelabs.com</a>

Notes:

DEQ	Montana Department of Environmental Quality
FSP	Field Sampling Plan
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
TTEMI	Tetra Tech EM Inc.

Figure 4 – Project Team Organization Chart

#### **1.4.2 Agency Oversight**

Agency field oversight may be conducted during all field activities associated with this project. Agency oversight personnel will have the ability to inspect all field and sampling activities, determine the appropriateness of the recorded data, and ensure that all activities comply with standard practices that meet the project objectives. All oversight personnel will be briefed by the TTEMI onsite health and safety coordinator (OHSC) prior to conducting oversight activities.

#### **1.4.3 Non-Agency Observation of Field Activities**

Noticed potentially liable persons (PLP) will be allowed the opportunity to observe field activities associated with this project. The request for non-agency observation of field activities must first be coordinated with DEQ/RD. Noticed PLPs must first separately arrange for and obtain access authorization in writing from the property owner to enter upon and take samples from any property that is not their own. For their own property, and for other properties where access authorization has been obtained, the noticed PLPs will have the opportunity to (1) observe TTEMI field and sampling activities, and (2) obtain split samples. Noticed PLPs must (1) supply all necessary sample bottles, supplies and materials, (2) arrange for laboratory analysis of all split samples, and (3) pay for all analyses of split samples they collect. Noticed PLP personnel will be briefed by the TTEMI OHSC prior to observation of field activities.

If a split sample is requested by an individual property owner, TTEMI personnel will, before leaving the property, provide a DEQ standard receipt (Appendix C) describing the sample(s) obtained and/or a portion of each sample, to the owner, operator or other person in charge of the place from which the sample(s) were obtained. If individual property owners request a split sample, they must supply all necessary sample bottles, supplies and materials required for sampling, as well as arrange for and pay for laboratory analyses of all split samples collected. If the owner, operator or other person in charge of the place from which the sample(s) were obtained is not present, a DEQ standard receipt describing the sample(s) obtained will be mailed at a later date. A copy of the results of any analysis made of such samples shall be furnished promptly to the owner, operator, tenant or other person in charge, if such person can be located.

## **1.5 SPECIAL TRAINING AND CERTIFICATION**

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the requirements for TTEMI and subcontractor personnel working on site.

### **1.5.1 Health and Safety Training**

TTEMI personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations (29 CFR) Part 1910.120(e). These requirements include: (1) 40 hours of formal offsite instruction; (2) a minimum of three days of actual onsite field experience under the supervision of a trained and experienced field supervisor; and (3) eight hours of annual refresher training. In addition, all TTEMI personnel and subcontractors involved with the KRY site RI must read and abide by the stipulations and guidelines set forth in TTEMI's Health and Safety Plan, which is Attachment 2 to this RIWP.

Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least eight additional hours of specialized supervisor training. The supervisor training covers TTEMI health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every TTEMI field team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular" or equivalent.

Copies of TTEMI's health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training are maintained in project files.

Before work begins at a specific hazardous waste project site, TTEMI personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at a hazardous waste project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards

- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances
- Contents of the HASP

### **1.5.2 Subcontractor Training**

Subcontractors who work on site will certify that their employees have been trained for work on hazardous waste project sites. Training will meet OSHA requirements defined in 29 CFR 1910.120(e). Before work begins at the project site, subcontractors will submit copies of the training certification for each employee to TTEMI.

All employees of associate and professional services firms and technical services subcontractors will attend a safety briefing and complete the “Safety Meeting Sign-Off Sheet” before conducting onsite work. This briefing covers the topics described in Section 1.5.1 and is conducted by the TTEMI OHSC or other qualified person.

Construction service subcontractors are responsible for conducting their own safety briefings. TTEMI personnel may audit these briefings.

## **1.6 DOCUMENTS AND RECORDS**

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of the field investigations at the KRY site.

### **1.6.1 Field Documentation**

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP and that all fieldwork is in conformance with TTEMI’s SOPs provided in Appendix B of this SAP. Note that in some cases, field procedures described in SOPs may not be applicable to field work conducted under this SAP, or specific methods described in the text of this SAP may vary from the methods described in the SOPs provided in Appendix B. In these cases, the procedures proposed in the text of this SAP supersede SOP methodologies.



Recording of notes in a field logbook will follow SOP 024 (Appendix B). Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the site name, the names of subcontractors, and the project manager. All field entries will be written in black or blue indelible ink. All corrections will be made utilizing a single line through the error, along with the date the correction was made, and the field personnel's initial. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all onsite personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken, including the direction in which the photo was taken

The field team will also use the various field forms included in Appendix C to record field activities.

### **1.6.2 Summary Data Package**

Laboratory subcontractors will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA 1999a, 2000a). The summary data package will consist of a case narrative, copies of all associated chain-of-custody forms, sample results, and QA/QC summaries. The case narrative will include the following information:

- Subcontractor name, project name, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample identification numbers
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies, including analyses performed without an American Association for Laboratory Accreditation (A2LA)-certified standard
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional summary data package requirements are outlined in Table 6. The laboratory subcontractors will provide TTEMI with two copies of the summary data package within 28 days after they receive the last sample in the SDG.

### **1.6.3 Full Data Package**

When a full data package is required, the laboratory subcontractors will prepare data packages in accordance with the instructions provided in the EPA CLP statements of work (EPA 1999a, 2000a). Full data packages will contain all of the information from the summary data package and all associated raw data. Full data package requirements are outlined in Table 6. Full data packages are due to TTEMI within 35 days after the last sample in the SDG is received. Unless otherwise requested, the subcontractor will deliver one copy of the full data package.

### **1.6.4 Data Package Format**

EDDs are required for all sample analytical results. An automated laboratory information management system must be used to produce the EDD. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDD will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with DEQ/RD specified standards. Results that should be included in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the chain-of-custody form
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG
- All re-analysis, re-extractions, or dilutions reported for the SDG, including those associated with samples and the specified laboratory QC samples
- Laboratory assigned qualifiers

TABLE 6

## REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

Requirements for Summary Data Packages – Organic Analysis		Requirements for Summary Data Packages – Inorganic Analysis	
<u>Section I</u>	Case Narrative	<u>Section I</u>	Case Narrative
1.	Case narrative	1.	Case narrative
2.	Copies of nonconformance and corrective action forms	2.	Copies of nonconformance and corrective action forms
3.	Chain-of-custody forms	3.	Chain-of-custody forms
4.	Copies of sample receipt notices	4.	Copies of sample receipt notices
5.	Internal tracking documents, as applicable	5.	Internal tracking documents, as applicable
<u>Section II</u>	Sample Results – Form I for the following:	<u>Section II</u>	Sample Results – Form I for the following:
1.	Environmental samples, including dilutions and re-analysis	1.	Environmental sample including dilutions and re-analysis
2.	Tentatively identified compounds (VOC and SVOC only)		
<u>Section III</u>	QA/QC Summaries – Forms II through XI for the following:	<u>Section III</u>	QA/QC Summaries – Forms II through XIV for the following:
1.	System monitoring compound and surrogate recoveries (Form II)	1.	Initial and continuing calibration verifications (Form II)
2.	MS and MSD recoveries and RPDs (Forms I and III)	2.	PRRL standard (Form II)
3.	Blank spike or LCS recoveries (Forms I and III-Z)	3.	Detection limit standard (Form II-Z)
4.	Method blanks (Forms I and IV)	4.	Method blanks, continuing calibration blanks, and preparation blanks (Form III)
5.	Performance check (Form V)	5.	Inductively coupled plasma (ICP) interference-check samples (Form IV)
6.	Initial calibrations with retention time information (Form VI)	6.	MS and post-digestion spikes (Forms V and V-Z)
7.	Continuing calibrations with retention time information (Form VII)	7.	Sample duplicates (Form VI)
8.	Quantitation limit standard (Form VII-Z)	8.	LCSs (Form VII)
9.	Internal standard areas and retention times (Form VIII)	9.	Method of standard additions (Form VIII)
10.	Analytical sequence (Forms VIII-D and VIII-Z)	10.	ICP serial dilution (Form IX)
11.	Gel permeation chromatography (GPC) calibration (Form IX)	11.	Instrument detection limit (Form X)
12.	Single component analyte identification (Form X)	12.	ICP interelement correction factors (Form XI)
13.	Multicomponent analyte identification (Form X-Z)	13.	ICP linear working range (Form XII)
14.	Matrix-specific method detection limit (Form XI-Z)		

TABLE 6 (Continued)

## REQUIREMENTS FOR SUMMARY AND FULL DATA PACKAGES

Requirements for Full Data Packages – Organic Analysis	Requirements for Full Data Packages – Inorganic Analysis
<b>Sections I, II, and III Summary Package</b>	<b>Sections I, II, III Summary Package</b>
<b>Section IV Sample Raw Data – indicated form, plus all raw data</b>	<b>Section IV Instrument Raw Data – Sequential measurement readout records for ICP, graphite furnace atomic absorption (GFAA), flame atomic absorption (AA), cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:</b>
1. Analytical results, including dilutions and re-analysis (Forms I and X)	1. Environmental samples, including dilutions and re-analysis
2. Tentatively identified compounds (Form I — volatile organic analysis [VOA] and SVOA only)	2. Initial calibration
	3. Initial and continuing calibration verifications
<b>Section V QC Raw Data – indicated form, plus all raw data</b>	4. Detection limit standards
1. Method blanks (Form I)	5. Method blanks, continuing calibration blanks, and preparation blanks
2. MS and MSD samples (Form I)	6. ICP interference check samples
3. Blank spikes or LCSs (Form I)	7. MS and post-digestion spikes
<b>Section VI Standard Raw Data – indicated form, plus all raw data</b>	8. Sample duplicates
1. Performance check (Form V)	9. LCSs
2. Initial calibrations, with retention-time information (Form VI)	10. Method of standard additions
3. Continuing calibrations, with retention-time information (Form VII)	11. ICP serial dilution
4. Quantitation-limit standard (Form VII-Z)	<b>Section V Other Raw Data</b>
5. GPC calibration (Form IX)	1. Percent moisture for soil samples
<b>Section VII Other Raw Data</b>	2. Sample digestion, distillation, and preparation logs, as necessary
1. Percent moisture for soil samples	3. Instrument analysis log for each instrument used
2. Sample extraction and cleanup logs	4. Standard preparation logs, including initial and final concentrations for each standard used
3. Instrument analysis log for each instrument used (Form VIII-Z)	5. Formula and a sample calculation for the initial calibration
4. Standard preparation logs, including initial and final concentrations for each standard used	6. Formula and a sample calculation for soil sample results
5. Formula and a sample calculation for the initial calibration	
6. Formula and a sample calculation for soil sample results	

Note: Special arrangements will be made to ensure that the laboratories report solid matrix results on a dry-weight basis, and that percent moisture is included in the summary packages.

Electronic and hard copy data must be retained for a minimum of three and ten years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system. The DEQ/RD official files will be the final location of all records affiliated with the KRY site.

#### **1.6.5 Reports Generated**

TTEMI will provide DEQ/RD with (1) monthly status reports (MSR) summarizing activities completed during the prior month of field activities, and field activities anticipated during subsequent months, and (2) weekly progress report to summarize activities throughout the field investigation. Additional reporting of the results obtained through implementation of this SAP includes a table summarizing unvalidated sample results for any residential samples within 10 days of receipt of these results from the laboratory.

## **2.0 DATA GENERATION AND ACQUISITION**

This section describes the requirements for the following:

- Sampling Process Design (Section 2.1)
- Sampling Methods (Section 2.2)
- Sample Handling and Custody (Section 2.3)
- Analytical Methods (Section 2.4)
- Quality Control (Section 2.5)
- Equipment Testing, Inspection, and Maintenance (Section 2.6)
- Instrument Calibration and Frequency (Section 2.7)
- Inspection and Acceptance of Supplies and Consumables (Section 2.8)
- Non-direct Measurements (Section 2.9)
- Data Management (Section 2.10)

### **2.1 SAMPLING PROCESS DESIGN**

TTEMI is proposing the installation of monitoring wells and the advancement of additional soil borings to satisfy a wide array of objectives (see Section 1.3.1). In addition, the sample process design includes collection of groundwater, surface water, surface soil, subsurface soil, sediment, and sludge/oily waste

samples. This SAP also allows for additional opportunistic samples of solid or liquid matrix samples, as appropriate.

Newly collected data will provide the basis for (1) further characterization of the extent and magnitude of contamination of known and potential sources, (2) investigation of the nature, extent, and migration of contamination, (3) fulfilling additional data needs to support risk characterization, and (4) fulfilling additional data needs to support evaluation of remedial alternatives and the ongoing ozonation of groundwater. The following subsections present the proposed sample locations and analyses planned. This information is also summarized in Tables 7 and 8. A detailed description of all samples proposed in this SAP and the rationale for sampling is provided in Appendix F, Table F-1. The proposed sampling locations are also provided on Figure 5A (surface soil), Figure 5B (subsurface soil), Figure 5C (monitoring wells), and Figure 5D (surface water and sediment). The various types of monitoring points proposed to be sampled in this SAP are summarized below:

<b>Proposed Monitoring Point</b>	<b>Total Number of Monitoring Points Proposed</b>
Existing shallow monitoring wells – unconfined aquifer	38
Existing deep monitoring wells – unconfined aquifer	5
Existing industrial wells – unconfined aquifer	8
Known residential wells – unconfined aquifer	11
Newly proposed shallow monitoring wells – unconfined aquifer	28
Newly proposed LNAPL monitoring wells – unconfined aquifer	7
Newly proposed piezometers – unconfined aquifer	2
Newly proposed deep monitoring wells – unconfined aquifer	21
Newly proposed deep monitoring wells – confined aquifer	1
Newly proposed surface water stations – Stillwater River	5
Newly proposed sediment stations – Stillwater River	5
Newly proposed subsurface soil borings and sampling from 4 to 6 ft; 8-10 ft; and from smear zone, if PID screen is positive <sup>a</sup> )	34
Newly proposed subsurface soil borings and PID screen; and sampling from smear zone, if PID screen is positive)	32
Newly proposed surface soil sample points	140

Notes:

<sup>a</sup> A positive PID screen is defined as any result greater than ambient conditions

PID Photoionization detector

ft feet

LNAPL Light non-aqueous phase liquid

**TABLE 7**  
**PROPOSED SOIL AND GROUNDWATER SAMPLES, ANALYSES AND OBJECTIVES**

Sample Type	Proposed Number of Stations/Samples <sup>a</sup>	Method Number for Analysis	Parameters of Interest <sup>a</sup>	Rationale for Sampling
Groundwater	<u>Unconfined Aquifer</u> 38 existing shallow monitoring wells 5 existing deep monitoring wells 8 existing industrial wells 11 existing residential wells (Note: As yet undiscovered residential wells located to the north and east of the Reliance facility will be sampled, if encountered) 28 newly proposed shallow monitoring wells 21 newly proposed deep monitoring wells 7 newly proposed LNAPL monitoring wells 2 newly proposed piezometers	EPA 8151A Massachusetts Method EPA 8260B EPA 8270C EPA 8270SIM EPA 200.7/200.8/200.9  EPA 8290 EPA E300.0/A4500CLB EPA 8315 Mod. EPA 300.0	PCP EPH/VPH VOC SVOC PAHs Metals, including tetraethyl lead Dioxins and furans Chloride Formaldehyde Bromate Field parameters	See Appendix F, Table F-1
	<u>Confined Aquifer</u> 1 newly proposed deep monitoring well			
Groundwater	TBD by WRI	TBD by WRI	MNA parameters	TBD by WRI
Groundwater	<u>Unconfined Aquifer</u>  Newly proposed monitoring wells: KRY-121A / KRY-121B KRY-131A / KRY-131B	NA	Short duration pumping test (1 hour)	Estimate Transmissivity
Surface water	5 stations along the Stillwater River	EPA 8151A Massachusetts Method EPA 8260B EPA 8270C EPA 8270SIM EPA 200.7/200.8/200.9  EPA 8290	PCP EPH/VPH VOC SVOC PAHs Metals, including tetraethyl lead Dioxins and furans Field parameters	See Appendix F, Table F-1

**TABLE 7 (Continued)**  
**PROPOSED SOIL AND GROUNDWATER SAMPLES, ANALYSES AND OBJECTIVES**

Sample Type	Proposed Number of Stations/Samples <sup>a</sup>	Method Number for Analysis	Parameters of Interest <sup>a</sup>	Rationale for Sampling
Surface soil	Surface (0 to 2 inches) - 15 Surface (0 to 6 inches) – 101 Surface (opportunistic) -10 Surface (0.5 to 1 ft) - 12 Surface (1 to 2 ft) – 12 Surface (residential) - 11 Surface (background) - 3 <b>Total - 164</b>	EPA 8151A Massachusetts Method EPA 624/8260B EPA 8270C EPA 8270SIM SW 3050/6010B  EPA 8290 SW 1312	PCP EPH/VPH VOC SVOC PAHs Metals, including tetraethyl lead Dioxins and furans SPLP	See Appendix F, Table F-1
Subsurface soil	Subsurface (4 to 6 ft) – 34 Subsurface (8 to 10 ft) – 34 Subsurface (smear zone) - 34  Additional subsurface (smear zone) – 32 Subsurface (opportunistic) – 10 <b>Total - 144</b>	EPA 8151A Massachusetts Method EPA 624/8260B EPA 8270C EPA 8270SIM SW 3050/6010B  EPA 8290 SW 1312	PCP EPH/VPH VOC SVOC PAHs Metals, including tetraethyl lead Dioxins and furans SPLP	See Appendix F, Table F-1
Subsurface soil	3 locations from the unsaturated zone 3 locations from the saturated zone  (KRY-107, KRY-121, and KRY-131)	ASTM D698-91 ASTM D-653-90 EPA 415.2/A5310C USDA Handbook 60, Method 26  ASA Monograph #9, Part 1, Method 15-5	Bulk density Porosity TOC Moisture content Grain size analysis  pH	See Appendix F, Table F-1



**TABLE 7 (Continued)**  
**PROPOSED SOIL AND GROUNDWATER SAMPLES, ANALYSES AND OBJECTIVES**

Sample Type	Proposed Number of Stations/Samples <sup>a</sup>	Method Number for Analysis	Parameters of Interest <sup>a</sup>	Rationale for Sampling
Sediment samples	5 stations along the Stillwater River	EPA 8151A Massachusetts Method EPA 624/8260B EPA 8270C EPA 8270SIM SW 3050/6010B  EPA 415.2/A5310C	PCP EPH/VPH VOC SVOC PAHs Metals, including tetraethyl lead TOC	See Appendix F, Table F-1

**Notes:**

a Not all samples will be analyzed for all parameters of interest. See Appendix F, Table F-1 for details. Maximum number of samples possible is presented in this table.

ASA	American Standards Association
ASTM	American Society for Testing Materials
EPA	U.S. Environmental Protection Agency
EPH	Extractable petroleum hydrocarbon
LNAPL	Light non-aqueous phase liquid
MNA	Monitored neutral attenuation
Mod.	Modified
NA	Not applicable
PAH	Polynuclear aromatic hydrocarbon
PCP	Pentachlorophenol
SPLP	Synthetic precipitation leaching procedure
TBD	To be determined
TOC	Total organic carbon
SPLP	Synthetic precipitation leaching procedure
SVOC	Semivolatile organic compound
USDA	U.S. Department of Agriculture
VOC	Volatile organic compound
VPH	Volatile petroleum hydrocarbons
WRI	Western Research Institute

Special arrangements will be made to ensure that the laboratories report solid matrix results on a dry-weight basis, and that percent moisture is included in the summary packages. Reporting on dry-weight basis works best when it is properly set-up at the time of sample login at the laboratory.

TABLE 8

## SUMMARY OF SOIL AND GROUNDWATER ANALYSES

Parameters	Matrix	Total Number of Field Samples <sup>a</sup>	Source Water Blanks (at 5%)	Trip Blanks (VOCs, only) (at 5%)	Equipment Rinsate Blanks <sup>b</sup> (at 5%)	Liquid Matrix Duplicates (at 5%)	Total Number of Samples <sup>a</sup>	MS/MSD (at 5%) <sup>a,c</sup>
See Appendix F, Table F-1	Soil-surface	164	NA	9	NA	NA	173	9
See Appendix F, Table F-1	Soil-subsurface	144	8	8	8	NA	168	9
See Appendix F, Table F-1	Groundwater	112	6	6	6	6	136	7
See Appendix F, Table F-1	Surface water	5	1	1	1	1	9	1
See Appendix F, Table F-1	Sediment	5	0 <sup>d</sup>	0 <sup>d</sup>	NA	NA	5	1
Standard Suite plus IDW suite	Soil - IDW	15	NA	NA	NA	NA	15	1
Standard Suite plus IDW suite	Water - IDW	42	NA	NA	NA	NA	42	3

**Notes:**

- a Total number of samples based on the maximum number of proposed samples (Table 7). Each surface soil sample will be collected with a new disposable trowel; therefore decontamination of sampling equipment is not necessary. Duplicates for solid matrix samples will not be collected.
- b Pertains to rinsate collected after decontamination of split spoon or roto sonic core is complete. An equipment blank may also be collected at the request of DEQ, per DEQ low-flow sampling guidance (Appendix B).
- c Matrix spike and matrix spike duplicates are not considered additional samples.
- d The total number of sediment samples and surface water samples is less than 20. Therefore, one blank of each type is sufficient.

IDW Investigation-derived waste  
IDW suite Chlorinated and non-chlorinated pesticides, chlorinated herbicides, pH, ignitability, reactivity, and whole effluent toxicity metals  
MS/MSD Matrix spike/matrix spike duplicate  
NA Not applicable (note that duplicates for solid matrix samples or IDW will not be collected or analyzed)  
VOC Volatile organic compound  
Standard Suite Standard suite of analytes (see Section 2.4) as follows:

**Liquid matrix analyses:**

Pentachlorophenol (PCP): By EPA Method 8151A (or equivalent), detection limit 0.1 micrograms per liter (µg/L).

Extractable petroleum hydrocarbon (EPH)/volatile petroleum hydrocarbon (VPH): By Massachusetts Method, DEQ guidance dated October 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 300 µg/L total EPH will be subjected to EPH fractionation.

VOC: By EPA Method 8260B, detection limit generally 0.5 µg/L.

Semivolatile organic compound (SVOC): By EPA Method 8270C (Polynuclear aromatic hydrocarbons [PAH] by 8270 SIM), detection limit generally 10 µg/L.

Chloride: By EPA E300.0/A4500CLB

**TABLE 8 (Continued)**

**SUMMARY OF SOIL AND GROUNDWATER ANALYSES**

**Solid matrix analyses:**

PCP: By EPA Method 8151A (or equivalent), detection limit 0.002 milligrams per kilogram (mg/kg).

EPH/VPH: By Massachusetts Method, DEQ guidance dated October 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 50 mg/kg total EPH will be subjected to EPH fractionation.

VOC: By Method 8260B, detection limit generally 0.2 mg/kg.

SVOC: By EPA Method 8270C (PAHs by 8270 SIM), detection limit generally 0.33 mg/kg.

Note: Special arrangements will be made to ensure that the laboratories report solid matrix results on a dry-weight basis, and that percent moisture is included in the summary packages. Reporting on dry-weight basis works best when it is properly set-up at the time of sample login at the laboratory.

Figure 5A

Figure 5B

Figure 5C

Figure 5D

### **2.1.1 Investigation of Source Areas**

The investigation of source areas includes advancement of soil borings to be completed as monitoring wells, monitoring well installation and development, surface and subsurface soil sampling, and investigation of the areal extent of LNAPL. These components of the investigation are discussed in the following sections below.

#### **2.1.1.1 Source Areas - Soil Borings/Monitoring Wells and Soil Sampling**

Soil borings at newly proposed monitoring well locations (KRY-100A, KRY-103A, KRY-103B, KRY-114A, KRY-114B, KRY-126A and KRY-127A) will be advanced with either a hollow stem auger (HSA) or rotosonic drill rig, as appropriate. Continuous soil cores will be collected from the borehole and logged using the Unified Soil Classification System (USCS). The locations of proposed soil borings and monitoring wells are provided on Figures 5B and 5C, respectively. At each shallow boring location, the surface soil sample(s) will be collected using a new disposable hand trowel. Subsurface soil samples will be collected from the soil core, as discussed below and in SOP 005 (Appendix B). Note that no soil samples will be collected from deep borings, unless otherwise noted in Appendix F, Table F-1. The rationale for subsurface soil sampling is provided on Table F-1.

In general, soil samples will only be collected for laboratory analysis from each soil boring in which a shallow monitoring well will be completed, and may include the following depth intervals:

- Surface Soil: 0 to 0.5 ft bgs
- Subsurface Soil: 4 to 6 ft bgs, and 8 to 10 ft bgs. An additional soil sample may be collected from the smear zone (2 ft above the water table to the water table) if field screening with a PID, odor, or visual observation indicates that the soil is contaminated. Additional samples may also be collected from other depth intervals as opportunistic samples, if needed.

Soil samples will be collected from the soil core and placed in an appropriate sample container (see Section 2.1.5). The PID screen will be conducted by partially filling a half-gallon zip-lock bag with soil and taking a headspace reading after the bag is warmed. A positive PID screen is defined as any result greater than ambient conditions. Samples will be analyzed as identified in Appendix F, Table F-1. Sludge and oily waste samples collected from borings in source areas in the vicinity of proposed monitoring wells KRY-126 and KRY-127 will also undergo additional analysis for dioxins and furans.



### **2.1.1.2 Source Areas - Monitoring Well Construction**

This SAP proposes constructing five shallow monitoring wells KRY-100A, KRY-103A, KRY-114A, KRY-126A and KRY-127A and two deep monitoring wells KRY-103B, KRY-114B in identified source areas. Shallow monitoring wells will be completed with 20-foot screen lengths, leaving approximately 13 ft of screen below the water table. Deep monitoring wells will be completed with 10 ft of screen, with the entire length of screen above the top of the clay confining unit. All shallow and deep monitoring wells proposed in this SAP will be completed in separate boreholes. The locations of proposed monitoring wells are provided on Figure 5C. Monitoring well construction is discussed in Section 2.2.1.1 of this SAP. Well construction diagrams are provided in Appendix G. Newly proposed monitoring wells will be constructed in accordance with State of Montana monitoring well standards, including:

- 37-43-101 to 402, Montana Code Annotated (MCA) (provides regulations and licensing for drillers and well installers)
- Administrative Rules of Montana 36.21.701 -810 (requirements for licensing and construction standards for drilling and installation of wells)
- 85-2-516, MCA (requirement to file a well log with DNRC)

### **2.1.1.3 Source Areas - Monitoring Well Development**

Monitoring well development activities will be performed in accordance with SOP 021 (Appendix B), and additional details provided in Section 2.2.1.2 of this SAP. Monitoring wells will be developed no sooner than 48 hours after well construction is completed to allow the grout in the annular spacing to completely hydrolyze, and the surface seal cement to harden.

### **2.1.1.4 Source Areas - Additional Soil Borings and Subsurface Soil Sampling**

Soil borings will be advanced in or adjacent to the former treating vats and excavation area at the KPT facility. One boring will be advanced in the historic excavation area. Eight borings (two borings on each side of the excavation) will be advanced by stepping out 25 ft from the perimeter of each side of the former excavation. Subsurface soil samples will be collected for laboratory analysis from each soil boring and, at a minimum, will include the following depth intervals: 4 to 6 ft bgs and 8 to 10 ft bgs. An additional soil sample may be collected at the smear zone (2 ft above the water table to the water table) if field screening with a PID, odor, or visual observation indicates that the soil is contaminated. A positive

PID screen is defined as any result greater than ambient conditions. Additional samples may also be collected from other depth intervals as opportunistic samples, if needed.

Subsurface soil sample locations will be collocated with surface soil sample locations, when possible (Section 2.1.1.5). The proposed subsurface soil sampling locations and chemical analyses to be performed are provided on Figure 5B and in Appendix F, Table F-1. The rationale for sampling at each location is summarized in Table F-1.

#### **2.1.1.5 Source Areas - Surface Soil Sampling**

Soil samples (0 to 0.5 ft bgs) will be collected in, or adjacent to the former treating vats and excavation area at the KPT facility. Specifically, one surface soil sample will be collected within the historic excavation to characterize the backfill. Eight surface soil samples (two samples on each side of the excavation) will be collected by stepping out 25 ft from the perimeter of each side of the former excavation, and will be collocated with subsurface soil sampling points. Surface soil sampling locations and analyses to be performed are provided on Figure 5A and Appendix F, Table F-1. The rationale for sampling at each location is summarized in Table F-1.

Soil samples (0 to 2 inches bgs) will be collected both in and adjacent to a fenced off sludge area east of the rail road tracks at the Reliance facility. One surface soil sample will be collected within the fenced area to characterize the sludge material. Additional surface soil samples will be collected outside of the fenced area. In addition to the standard suite of analytes, samples will be analyzed for dioxins and furans, TCLP, and Polychlorinated biphenyl (PCBs) to assist in evaluating characteristics and disposal options. Surface soil sampling locations and analyses to be performed are provided on Figure 5A and Appendix F, Table F-1. The rationale for sampling at each location is summarized in Table F-1.

#### **2.1.1.6 Source Areas - LNAPL Investigation**

Seven borings will be advanced (four at the Reliance facility and three at the KPT facility) and an LNAPL monitoring well will be installed in each boring. This SAP proposes that LNAPL monitoring wells be completed identical to shallow monitoring wells (Section 2.1.1.2). An interface probe will be used to measure the static water level and the depth of measurable LNAPL in each well (if present) no sooner than four weeks after LNAPL well construction and development. These data will assist in defining the areal extent of LNAPL greater than 0.1 ft in thickness. No additional groundwater sample collection or

analysis is proposed for any of the LNAPL monitoring wells. The locations of all proposed LNAPL monitoring wells are provided on Figure 5B and Figure 5C.

### **2.1.2 Investigation of Nature, Extent, and Migration of COPCs**

The investigation of the nature, extent, and migration of COPCs focuses on the:

- Extent and magnitude of soil contamination outside of suspected source areas,
- Lateral and vertical extent of the groundwater contamination throughout the site,
- Aquifer characteristics and migration pathways,
- Nature and extent of surface water and sediment contamination, and
- Interaction of surface water and groundwater at the site.

Proposed sampling activities are described in detail below.

#### **2.1.2.1 Nature and Extent - Surface Soil Sampling**

Previous investigations detected elevated concentrations of COPCs in surface soil outside of the immediate vat treating area and excavation at the KPT facility. In addition, leaking drums, ASTs, miscellaneous industrial waste, and large areas of fill were noted during recent site reconnaissance at the KPT facility. Surface contamination at source areas at the KPT facility may have been transported to other areas of the site through various means, including: earth moving activities, wind erosion, surface water runoff, vehicle traffic, or other means. Soils and groundwater at the KPT facility within the Stillwater River meander have not previously been sampled. Additional surface soil data for metals including tetraethyl lead, dioxins, and furans are needed at the KPT facility. Lastly, the railroad right-of-way has not previously been sampled.

Previous investigations detected elevated concentrations of COPCs in surface soil at the Reliance facility; however, surface soils were not collected on the Swank property on the northeast corner of the facility, nor along the railroad right-of-way on the Reliance Facility. Surface soil data were not collected on the Swank property during recent sampling (fall 2005). Surface soils in the residential area north of the Reliance facility have not been sampled and analyzed for all COPCs. Surface soils associated with the Yale Oil facility have not been sampled and analyzed for all COPCs. Lastly, surface soil data for (1) metals (including tetraethyl lead), and (2) dioxins and furans, are needed at both the Reliance and Yale facilities.

Most surface soil samples collected on the KPT, Reliance, and Yale Oil facilities and vicinity will be analyzed for the standard suite of analytes (see Section 2.4). Some samples may be additionally analyzed for other parameters (for example: metals, including tetraethyl lead, and dioxins and furans), in order to satisfy multiple investigation objectives. Lastly, some selected surface soil samples may be analyzed for only one or more of the following analytes: dioxins and furans, PCP, PCBs, TCLP, and SPLP. All surface soil sampling locations are provided on Figure 5A. The rationale for sampling at each location and the list of analytes to be analyzed are summarized in Table F-1.

Possible surface soil depth intervals that will be sampled include (not all surface depth intervals will be sampled at every location):

- 0 to 6 inches bgs, for samples located within the approximate facility boundary;
- 0 to 2 inches bgs, for samples located outside the approximate facility boundary;
- 0.5 to 1.0 ft bgs and 1.0 to 2.0 ft bgs for a subset of samples selected for dioxins, furans, and PCP analyses. Sampling of these additional surface soil depth intervals is described below.

A subset of surface soil samples outside of the area of historic vat treating area will be analyzed for dioxins and furans in addition to the standard suite of analytes (see Section 2.4 and Figure 5A). At these same sample locations, two additional surface soil depth intervals will be collected (0.5 to 1.0 ft, and 1.0 to 2.0 ft). These deeper surface soil samples will be analyzed for dioxins, furans, and PCP only. The proposed surface soil sampling locations requiring analysis for dioxins and furans are provided on Figure 5A, and a summary of the corresponding analyses required at each location is provided in Appendix F, Table F-1.

The extent of dioxins and furans in residential surface soils will be investigated by collecting surface soil samples (0 to 2 inches) in neighborhoods adjacent to the KRY site and analyzing these surface soil samples for dioxins and furans only. Residential surface soil sampling locations are provided on Figure 5A and summarized in Appendix F, Table F-1.

Three surface soil samples (0 to 2 inches) will be collected to establish background concentrations in soils (see Section 2.1.2.8). Background samples will be analyzed for the standard suite of analytes (see Section 2.4), plus metals including tetraethyl lead, and dioxins and furans. Representative background soil sample locations will be based on review of aerial photographs and current site conditions to select natural, undisturbed, or non-industrialized areas such as parks or naturally timbered areas. All proposed background locations must be approved by DEQ/RD prior to sampling. The proposed maximum number of background soil samples (three) was determined by DEQ/RD.

### **2.1.2.2 Nature and Extent - Subsurface Soil Sampling**

Previous investigations detected elevated concentrations of COPCs in subsurface soil outside of the immediate vat treating area and excavation at the KPT facility. In addition, leaking drums, ASTs, miscellaneous industrial waste, and large areas of fill were noted during site reconnaissance at the KRY facility in October 2005. Previous investigations also indicate there is an extensive contaminated smear zone extending downgradient from the source area at the KPT facility, and that this smear zone may be a secondary source of contamination to the unconfined aquifer. In addition, subsurface soils associated with (1) the northern portion of the KPT facility within the Stillwater River meander, (2) the northeastern and southern portions of the Reliance facility, and (3) the Yale Oil facility have not been sampled and analyzed for all COPCs. Lastly, limited data are available for metals, tetraethyl lead, dioxins, and furans in subsurface soils across the KRY site

In addition to the subsurface sampling for source areas proposed in Section 2.1.1, this SAP proposes that at least six subsurface soil samples be collected at each of the three facilities (KPT, Reliance, and Yale Oil). The following consistent depth intervals for subsurface soil sampling are proposed in this SAP:

- 4 to 6 ft bgs
- 8 to 10 ft bgs
- At smear zone (2 ft above the water table to the water table) if field screening with a PID, odor, or visual observation indicates that the soil is contaminated. Additional samples may also be collected from other depth intervals as opportunistic samples, if needed.

A positive PID screen is defined as any result greater than ambient conditions. Subsurface soil sampling locations and chemical analyses to be performed are provided on Figure 5B. The rationale for sampling at each location, and the rationale for the selection of COPCs to be analyzed are summarized in Table F-1.

### **2.1.2.3 Nature and Extent - Groundwater Sampling of Unconfined Aquifer**

The nature and extent of the dissolved plumes at the KRY site have not been fully defined to nondetection. For example, the upgradient boundaries of plumes have not been established because samples collected from existing monitoring wells KPT-1 and KPT-12 have historically exhibited PCP and dioxin concentrations above laboratory detection limits. To the south, samples collected from existing monitoring wells KPT-3 and KPT-4 historically exhibit LNAPL and elevated concentrations of PCP. To the north, samples collected from existing monitoring well KPT-9 historically exhibit detectable

concentrations of PCP and dioxins. In addition, the downgradient and lateral extent of the PCP plume is poorly defined south of the Reliance facility and east of the railroad right-of-way and Highway 2. In particular, petroleum hydrocarbons have been detected in samples collected from one of the furthest downgradient wells (SW-9); therefore, the maximum downgradient extent of the plume in this area is unknown. Lastly, the vertical extent of contamination in the unconfined aquifer is largely unknown.

In addition to the five shallow and two deep monitoring wells proposed in section 2.1.1.2, 23 shallow monitoring wells, 19 deep monitoring wells, and 2 piezometers will be completed to (1) define the vertical and lateral extent of groundwater contamination across the site, and (2) assist in characterizing the groundwater flow field and movement of groundwater near the Stillwater River. This SAP proposes that piezometers be completed identical to shallow monitoring wells (Section 2.1.1.2). Piezometers will be used to measure static water levels only; no groundwater samples will be collected at piezometers locations. Lithology collected during advancement of piezometer borings will be useful in better understanding the nature and extent of the area of perched clay in the northern area of the Reliance facility. Well construction details are provided in Appendix G.

In general, newly proposed well locations are oriented along east-west transects with an approximate spacing of at least 500 ft between transects and between wells within a transect (Figure 5C). However, this original scheme was subsequently modified and the overall number of proposed monitoring wells was reduced to account for new monitoring wells installed by BNSF consultants during preparation of the draft version of this document.

Well placement for newly proposed monitoring wells for the nature and extent investigation considered the current interpreted extent COPC plumes and the objective of defining the extent of groundwater contamination to the non-detection boundary, both areally and vertically. Areas requiring additional monitoring well coverage include: (1) downgradient of existing monitoring well KPT-4 from which samples have historically exhibited LNAPL and elevated concentrations of PCP, (2) upgradient of existing monitoring well GWY-10 from which samples have historically exhibited detectable concentrations of PCP, (3) an area in the northern portion of the Reliance facility and adjacent residential neighborhood where the geology is uncertain and where groundwater has historically exhibited COPCs above detection, and (4) an area east of Highway 2 where LNAPL and TPH have been detected.

Specific locations for newly proposed monitoring wells are presented in Figure 5C, and the rationale for sampling is summarized in Appendix F, Table F-1.

#### **2.1.2.4 Nature and Extent - Groundwater Sampling of Confined Aquifer**

One boring will be advanced through the clay aquitard and one deep monitoring well (KRY-121C) will be installed in the underlying confined aquifer, assuming LNAPL is not observed at the water table. If LNAPL is observed at the water table, an alternate location for the confined aquifer monitoring well will be selected. Special well construction methods will be used to assure well integrity and limit the potential for cross-contamination between the geologic zones. This confined aquifer well will be installed with a roto sonic rig and constructed as a dual cased well with 8-inch casing set 5 ft into the top of the clay aquitard and grouted to prevent cross-contamination between the unconfined aquifer and the underlying clay and confined aquifer. After the grout has cured, a smaller diameter borehole will be drilled through the grout into the deeper confined aquifer below the clay unit. A conventional well screen and riser will be set in the confined aquifer. A typical well constructed in this manner is shown in Appendix G, Figure G-2.

Preliminary evaluation of existing data suggest that the well screen slot size will be 0.02-inch, and that a 10/20 silica sand pack can be placed in the annular space to 2 ft above the screened interval. These specifications may vary somewhat once the actual boring is completed and the soil core has been logged. The remaining annular space will be sealed with grouting material to 1 ft bgs. The well will be developed no sooner than 48 hours after installation.

#### **2.1.2.5 Nature and Extent - Surface Water and Sediment Sampling**

Five surface water samples will be collected along the Stillwater River at stations KRY-200, KRY-201, KRY-202, KRY-203, and KRY-204 and will be collocated with five sediment samples collected at stations KRY-300, KRY-301, KRY-302, KRY-303, and KRY-304. Specific locations for newly proposed surface water and sediment stations are presented in Figure 5D, and the rationale for sampling is summarized in Appendix F, Table F-1. In general, the proposed sampling will assess the potential for onsite contamination to impact the Stillwater River. Stations KRY-200 and KRY-300 are located upstream of the KRY site near the Whitefish Stage Road bridge and have not likely been affected by site-related activities. Surface water stations KRY-201, KRY-202 and KRY-203, as well as sediment stations KRY-301, KRY-302, and KRY-303 are located in the northern portion of the KPT facility within a river meander that may have been impacted by site-related activities, surface runoff, and surface soil erosion from the KPT facility. All surface water samples will be collected as grab samples as outlined in SOP 009 (Appendix B). This SAP proposes that surface water samples in the river will be collected during low-flow conditions (non-irrigation season). All sediment samples will be collected using a gravity corer,

ponar (clam-shell) grab sampler, or other true sediment sampling device as outlined in SOP 006 (Appendix B). Additional details regarding surface water and sediment sampling are provided in Section 2.2 of this SAP.

#### **2.1.2.6 Nature and Extent - Surface Water and Groundwater Interaction**

The interaction of groundwater and surface water at the site will be investigated through collection and analysis of:

- Static water level measurements from monitoring wells,
- Measurements of river stage close to monitoring wells,
- Groundwater quality data close to surface water stations,
- Surface water quality and sediment data from the Stillwater River, and
- Opportunistic sample of groundwater in the McElroy and Wilken gravel pit, if encountered.

Static water level measurements in monitoring wells and groundwater elevation contour maps created using data from all existing and newly proposed monitoring wells will be compared to stage levels in the river to identify groundwater recharge or discharge areas, and to evaluate whether the river is gaining or losing in the vicinity of the site. Stage measurements will be collected at surface water monitoring stations KRY-200, KRY-201, KRY-202, KRY-203, and KRY-204. Surface water measurements will be collected following SOP 052, SOP 090, or SOP 095, as appropriate (Appendix B).

An opportunistic sample of ponded groundwater from the McElroy and Wilken gravel pit will be analyzed, if groundwater is encountered. Analytical requirements are provided in Appendix F, Table F-1.

#### **2.1.2.7 Nature and Extent - Unconfined Aquifer Characterization**

The monitoring station locations and sample collection proposed in previous sections of this SAP are sufficient for the purpose of characterizing some aquifer parameters, and estimating the magnitude and direction of groundwater flow. Specifically, existing data and newly collected hydrogeologic data are, or will be, sufficient to estimate the following aquifer parameters:



- Saturated thickness,
- Horizontal hydraulic gradient magnitude in the unconfined aquifer,
- Vertical hydraulic gradient magnitude in the unconfined aquifer,
- Horizontal hydraulic gradient direction in the unconfined aquifer,
- Vertical hydraulic gradient direction in the unconfined aquifer, and
- Vertical gradient magnitude and direction between the unconfined and confined aquifers.

However, existing data and data that will be collected as proposed in previous sections of this SAP are not sufficient to estimate the following aquifer parameters:

- Porosity,
- Bulk density,
- TOC of saturated zone soils, and
- Hydraulic conductivity.

Porosity, bulk density, and TOC of saturated zone soils are parameters that are required to calculate the retardation coefficient for COPCs. The retardation coefficient describes the relative velocity of groundwater compared to the velocity of organic contaminants in groundwater. The hydraulic conductivity provides an estimate of the ease with which groundwater moves through a porous medium.

Data for porosity, bulk density, and TOC will be collected at two proposed representative monitoring well locations (KRY-121B, and KRY-131B). As the boring is advanced, one soil sample from both the unsaturated zone and the saturated zone in each boring will be collected and analyzed to obtain estimates for TOC, porosity, and bulk density. Aquifer tests will be performed in shallow and deep monitoring wells KRY-121A/B and KRY-131A/B; these wells are oriented along the plume centerline in areas of plumes that are expected to be minimally contaminated. Soil boring and monitoring well locations for the KRY site are presented on Figure 5C. Sample locations and analyses are also summarized in Appendix F, Table F-1.

#### **2.1.2.8 Nature and Extent - Background Characterization**

This SAP proposes that three surface soil samples will be collected at three locations DEQ/RD considers representative of background (see Section 2.1.2.1). Initial site reconnaissance and aerial photography suggest that representative background samples could be collected from undisturbed ground west and

northeast of the site along the Stillwater River, and on a hillside near the Walmart shopping center. However, sample locations will be finalized after consultation with DEQ/RD. Each background sample will be at a depth of 0 to 2 inches bgs. If the proposed sample is located in an area that is either (1) vegetated, or (2) contains duff or surface gravel, the organic material or gravel will first be removed and the sample will be collected immediately below this layer. Sample analyses are summarized in Appendix F, Table F-1.

### **2.1.3 Investigation to Support Risk Characterization**

This SAP proposes the collection of a variety of solid and liquid matrix samples from numerous monitoring stations located at the KRY site. The monitoring station locations and sample collection proposed in previous sections of this SAP (Section 2.1.1 and 2.1.2) are generally sufficient for the purpose of assessing and quantifying human health and environmental risks, with exceptions or additional details as described below.

#### **2.1.3.1 Risk - Surface Soil**

##### Surface Soil Sample Depths

Surface soil samples will be collected from undisturbed soil (beneath surface gravel or other ground cover) using a disposable trowel or hand corer, as appropriate. Note that if the depth of surface gravel is greater than 6 inches, the gravel itself will be sampled to determine if it is contaminated. Sample collection will follow general practices listed in SOP 005 (Appendix B). Per DEQ direction, the majority of surface soil samples proposed in this SAP will be collected from a depth of 0 to 0.5 ft bgs; however, all surface soil samples located outside of the approximate facility boundary will be collected from the 0 to 2 inch soil horizon. As discussed in Section 2.1.2.1, a subset of surface soil samples outside of the area of historic vat treating area will be analyzed for dioxins and furans, in addition to the standard suite of analytes. At these sample locations, two additional soil depth intervals will be collected (0.5 to 1.0 ft, and 1.0 to 2.0 ft) and will be analyzed for dioxins, furans, and PCP.

##### Surface Soil Sample Locations

Surface soil will be sampled in source areas (Section 2.1.1) and as part of the nature, extent, and migration of COPCs investigation (Section 2.1.2). Therefore, since data will already be available for

some judgmental (non-random) surface soil locations, these data will be combined with unbiased (grid) samples located where reasonable maximum exposure activity may occur, as explained in the RI work plan. Surface soils will also be sampled in residential areas adjacent to the site where migration of wind blown dust may have occurred.

#### Surface Soil Sample Analysis

Surface soil samples collected for use in risk assessment will be analyzed for the standard suite of analytes (PCP, EPH/VPH, VOC, and SVOC [including PAHs]) as well as a full metals suite, including tetraethyl lead. In addition, selected samples will be analyzed for dioxins and furans. Sample analyses are summarized in section 2.4 and Appendix F, Table F-1.

#### **2.1.3.2 Risk - Subsurface Soil**

##### Subsurface Soil Depths

Soil borings will be advanced using an HSA and/or rotosonic drill rig to obtain subsurface samples for use in risk characterization of utility/construction workers. All soil borings will be continuously cored and lithologically logged using the USCS. Discrete samples collected in a manner similar to those described in Section 2.1.1 and 2.1.2 will be analyzed at standard depths of 4 to 6 ft bgs and 8 to 10 ft bgs for risk characterization of potential concentrations in subsurface media to which a utility/construction worker may be exposed. The maximum 10 ft bgs depth is assumed to be the reasonable maximum depth to which utilities are likely to be found or installed in the KRY site area..

##### Subsurface Soil Sample Locations

Subsurface soil data are required for the human health risk assessment utility/construction worker scenario. Based on the nature of the anticipated exposure, grid or random sampling is impractical for establishing exposure concentrations. Instead, approximately half the total number of subsurface samples needed for risk assessment are proposed in source areas that are expected to exhibit maximum concentrations of COPCs, and the remaining subsurface samples are proposed in non-source areas at selected locations across the site.

### Subsurface Soil Collection and Analyses

Subsurface soil samples will be collected from the core or split spoon sampler. The soil will then be placed into a glass jar (containing preservative if necessary). Procedures for soil sampling are included in TTEMI SOP 005 (Appendix B).

Subsurface soil samples collected for use in assessment of risk will be analyzed for the standard suite of analytes (PCP, EPH/VPH, VOC, and SVOC [including PAHs]) as well as a full metals suite. In addition, selected samples will be analyzed for dioxins and furans and tetraethyl lead. Sample analyses are summarized in Appendix F, Table F-1.

#### **2.1.3.3 Risk - Groundwater**

The monitoring station locations and sample collection activities proposed in previous sections of this SAP are sufficient for the purpose of assessing risks for groundwater. No additional monitoring wells will be installed and no additional groundwater samples will be collected solely for risk assessment purposes. In addition, groundwater risks will be calculated only for constituents not identified in DEQ-7. For groundwater constituents identified in DEQ-7, State standards (DEQ-7) must be met.

#### **2.1.3.4 Risk - Surface Water**

The monitoring station locations and sample collection activities proposed previously in this SAP (Section 2.1.2.5) are sufficient for the purpose of assessing risks for surface water. Therefore, no additional sampling is required. When surface water and sediment samples are collocated at a single sampling point, undisturbed surface water samples will be collected for chemical analysis prior to collection of field parameters or sediment sampling to avoid cross contamination of samples.

### Surface Water Depths

No additional water elevation data from surface water stations will be collected solely for risk assessment purposes.

### Surface Water Sample Locations

No additional surface water stations will be sampled solely for risk assessment purposes. However, additional analyses of samples will be conducted, as summarized in Appendix F, Table F-1.

#### **2.1.3.5 Risk - Sediments**

No additional sediment sampling will occur solely for risk assessment purposes. However, additional analyses of samples will be conducted, as summarized in Appendix F, Table F-1.

#### **2.1.4 Investigation to Support Evaluation of Remedial Alternatives**

The monitoring station locations and sample collection proposed in previous sections of this SAP (Section 2.1) are generally sufficient and provide appropriate data to support evaluation of likely remedial alternatives, except as noted below.

Section 2.1.2.3 of this SAP proposes the installation of monitoring wells and the collection of solid matrix samples from the saturated zone to be analyzed for porosity, bulk density, and TOC. In order to evaluate likely remedial alternatives and to calculate scientifically based DAF using VS2DT software, this SAP also proposes the collection and analysis of unsaturated zone subsurface soils from two shallow monitoring well locations (KRY-121A, and KRY-131A). As the boring is advanced, one soil sample from the unsaturated zone in each soil shallow boring will be collected and analyzed to obtain estimates for:

- Bulk density,
- Porosity,
- TOC,
- Moisture content,
- Grain size analysis, and
- pH.

In addition, several samples from three areas anticipated to exhibit low-level contamination, mid-range contamination, and high-level contamination will be analyzed for SPLP to evaluate DAFs. Sample location are provided on Figure 5A (surface soil samples), Figure 5B (subsurface soil samples), and are summarized in Appendix F, Table F-1.

Groundwater upgradient to, and in the vicinity of the existing ozonation system will be analyzed for indicator analytes and breakdown products of PCP in an effort to evaluate the effectiveness of the ozonation system to reduce the concentrations of PCP in groundwater, and to evaluate whether the existing ozonation system may currently be generating toxic byproducts. This SAP proposes that the chloride ion and PCP concentrations be used as indicator analytes to evaluate the effectiveness of the existing ozonation system. Chloride has thus been added to the standard suite of analyses for groundwater. Toxic byproducts of the oxidation of PCP include aldehydes (specifically, formaldehyde), ketones (specifically, acetone), and bromate. Additional analysis for these classes of compounds in groundwater will be performed. Specifically, groundwater from the unconfined aquifer will be collected from (1) a shallow and deep monitoring well pair upgradient of the ozonation system (KRY-101A and KRY-101B), (2) a shallow and deep monitoring well pair close to the ozonation system (KPT-7 and KPT-8) and (3) a shallow and deep monitoring well pair downgradient of the ozonation system (KRY-114A and KRY-114B). All samples from these locations will be analyzed for (1) acetone as part of the standard suite of analyses (EPA method 8260B), (2) formaldehyde (EPA method 8315 Mod.), and (3) bromate (EPA 300.0 Mod.).

Groundwater from selected monitoring wells has been sampled and analyzed for MNA parameters by WRI in coordination with DEQ/RD as part of their research and investigation at the KRY site related to bioremediation and related remedial design efforts. No additional MNA parameter samples are identified for collection by TTEMI at this time. Once the WRI data is available for review, DEQ/RD and TTEMI may determine that some limited MNA parameter samples are warranted.

### **2.1.5 Rationale for Selecting Analytical Parameters**

The COPCs identified in DEQ/RD Task Order No. 37 include PCP, dioxins and furans, PAHs, diesel-range petroleum hydrocarbons, and metals, notably lead. This SAP proposes that solid and liquid matrix samples will be analyzed for COPCs using standard EPA methods as described in Section 1.2.2. Additional details related to method analysis and sample collection for the COPCs listed in Task Order No. 37 are provided in Section 2.1.5.

The presence of other contaminants at the KRY site is acknowledged and additional data may expand the list of COPCs. For example, TTEMI screened all previously collected solid and liquid matrix sample results to establish a list of analytes that were present in more than five percent of the samples above laboratory detection limits, and which for the purpose of the RI may potentially be considered COPCs.

Other COPCs may be identified during the RI. The list of analytes that may potentially be considered COPCs is provided in Appendix D, Table D-1. As another example, benzene-toluene-ethylbenzene-xylene (BTEX) is a suite of contaminants generally associated with petroleum fuels, and is detected in groundwater at the KRY site. The analytical methods proposed for COPCs will also detect individual BTEX compounds. Based on the above screening and analysis, a “standard suite” of analytes was developed that, in addition to the COPCs listed above, includes VOCs and SVOCs (see Section 2.4 for more detail).

During site reconnaissance in October 2005, areas within the Reliance facility boundary exhibited sludges and oily waste material at the surface. Samples from these areas will also be analyzed for PCBs and TCLP. In addition, selected soils from the KRY site will be analyzed for SPLP, and data will be used in support of future unsaturated zone modeling, if needed. Lastly, a groundwater ozonation system is currently operating at the KPT facility, and selected groundwater samples in this area will be additionally analyzed for parameters that will help assess (1) the effectiveness of the ozonation system, and (2) the potential for the system to create toxic byproducts in groundwater. Therefore, selected groundwater samples will be additionally analyzed for chloride, bromate, acetone, and formaldehyde.

#### **2.1.6 Surveying**

Recent RETEC survey data will be used if field confirmation shows it to be valid. The locations of newly proposed and existing monitoring wells (if RETEC survey results are not valid), and all newly proposed surface water stations will be surveyed to an accuracy of plus or minus 0.1 foot horizontally and plus or minus 0.01 foot vertically. Horizontal coordinates will be reported in accordance with the existing state planar coordinate system. Vertical coordinates will be reported as feet above mean sea level. The locations of all other proposed sampling and monitoring stations will be determined using Global Positioning System methods.

#### **2.1.7 Underground Utility Location and Clearance**

Preliminary utility locations were evaluated by reviewing several information sources: Evergreen Water and Sewer District underground water line maps, Qwest underground phone line maps, AT&T Broadband underground cable line maps, Flathead Electric underground electrical line maps, Northwest Energy (underground gas line maps), and site walk-through with property owners and operators. All available

information was reviewed to identify proposed sample locations that might intersect or otherwise interfere with known utility corridors. The locations of septic tanks were ascertained during the site walk-through.

In addition, TTEMI will contact Utility Locate Service (800-424-5555) before starting any intrusive or subsurface field activity. The utility locator will be responsible for clearing all proposed sample locations that require subsurface boring or excavation. If alternate sample locations are necessary, TTEMI will coordinate with DEQ/RD to evaluate and finalize the alternate sample locations.

#### **2.1.8 Access Arrangements**

TTEMI will provide DEQ/RD with a list of proposed residential, industrial, and commercial properties that require access authorization. The DEQ/RD will ensure access is available before starting any fieldwork that requires site access. TTEMI will notify the DEQ/RD if there are modifications to the list of sample locations before starting any field event.

### **2.2 SAMPLING METHODS**

This section describes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of investigation derived waste.

#### **2.2.1 Sampling Methods and Equipment**

Sampling requirements for this project call for the collection and analysis of samples from groundwater, surface water, sediments, soil, sludges and oily waste. All field activities will follow the methods and protocols detailed in this SAP and will be performed in accordance with TTEMI's HASP for the KRY site. The HASP is provided in the RIWP as Attachment 2. The following sections describe the sampling methods and equipment to be used during this project.



### **2.2.1.1 Monitoring Well Installation**

All new monitoring well installations will follow SOP 020 (Appendix B), with top of casing that is flush mounted or with casing stick-up, as appropriate. Appendix G provides well construction details. All materials used in construction of new monitoring wells will arrive to the worksite factory-sealed and will not require any decontamination prior to monitoring well installation.

Newly proposed monitoring wells will be constructed in accordance with State of Montana monitoring well standards, and all wells will be drilled by a licensed monitoring well installer. TTEMI will ensure that the well driller files the appropriate well logs with the Montana Department of Natural Resources and Conservation. All new monitoring well locations were selected after careful review of existing monitoring well locations and data, analysis of DQOs for this investigation, and input from and coordination with DEQ/RD personnel.

Shallow monitoring wells proposed for the unconfined aquifer will be constructed with a 20-foot screen; with approximately 7 ft of screen above the water table and 13 ft of screen below the water table to detect possible LNAPL. Deep monitoring wells proposed for the unconfined aquifer will be constructed with 10 ft of screen above the clay confining unit to define the vertical extent of contamination. One deep monitoring well will be advanced through the clay confining unit into the underlying confined aquifer. This deep confined aquifer monitoring well will be constructed with 10 ft of screen below the bottom of the clay aquitard. Groundwater will be sampled and analyzed to evaluate the presence of COPCs in the confined aquifer. Water levels will be measured for use in calculating vertical gradients. At locations where subsurface soil data must be collected from borings at proposed monitoring well locations, the shallow well boring will first be advanced with a HSA or roto sonic drill rig, and a separate deeper well boring will be located adjacent to the shallow boring with a roto sonic drill rig.

Material specifications and completion depths will be recorded during well construction and documented on a well completion log. The monitoring well will be constructed using 2-inch inside diameter Schedule 40 polyvinyl chloride (PVC) riser with flush threaded joints and Schedule 40 PVC screen with 0.02-inch machined slots. Monitoring wells in which aquifer testing is proposed will be completed using 4-inch identification schedule 40 PVC casing (KRY-121A, KRY121B, KRY 131A, and KRY131B).

The monitoring well filter pack will consist of 10-20 mesh silica sand placed from the bottom of the borehole to a minimum of two feet above the top of the screen. The annular seal placed above the filter pack will consist of approximately 2 ft of hydrated bentonite pellets. A grout mixture of 95 percent cement and five percent bentonite will be poured from the top of the annular seal to approximately 2 ft bgs. Concrete will then be poured in the space above the grout to form a surface seal and set the protective casing. The concrete surface seal will be sloped to allow for drainage of surface water away from the well. The volume of material placed in the borehole to form the filter pack, annular seal, and surface seal will be calculated and recorded on the well completion log.

#### **2.2.1.2 Monitoring Well Development and Sampling**

Monitoring well development activities will be performed in accordance with SOP 021 (Appendix B). The monitoring well will not be developed for a minimum of 48 hours after well completion to allow for adequate curing of the grout. Prior to well development, the depth to water, depth to LNAPL (if present), and total depth of the well will be measured using an electronic oil/water interface probe. These measurements will be used to determine the well casing volume and minimum purge volume. Before purging, the well will be surged by manually raising and lowering a surge block through the water column for a minimum of 10 minutes.

After the well has been surged, a portable pump will be used to evacuate a maximum of ten casing volumes of water from the well. A new piece of disposable tubing will be attached to the pump and lowered to variable depths below the water table to evacuate the water from the well and introduce groundwater into the well from the aquifer. Water quality parameters including pH, specific conductance, and temperature will be measured upon the removal of each casing volume of water to provide baseline information. Prior to use, all water quality meters will be calibrated in accordance with the manufacturer's specifications.

Monitoring well development will continue until two consecutive sets of water quality parameter measurements have stabilized to within 10 percent and the purge water is reasonably free of sediment, or until ten casing volumes have been removed. Monitoring well development activities will be documented on a well development form. After the well is developed, a groundwater sample will be collected as discussed in Section 2.2.1.3 of this SAP. As general requirements for this investigation (1) wells should not be developed sooner than 48 hours after completion and (2) there should be at least 48 hours between

well development and the commencement of groundwater sampling at each newly installed monitoring well.

Based on historical knowledge of the site and previous groundwater data collected in the plumes, all development water generated will be temporarily contained and subsequently treated onsite; then land applied onsite. Care will be taken to segregate well development water and purge water containing visible LNAPL.

Observations of water level, flow rate, and the quantity and clarity of the water withdrawn will be monitored during this process and recorded on water quality sheets during well development and while purging for sampling. During purging of the monitoring well using the bladder pump, field parameters will be measured using a closed flow-through cell system. Field parameters measured will include temperature, pH, conductivity, and dissolved oxygen. Low-flow purging (maximum discharge equal to 0.5 liters per minute) will continue until temperature, conductivity, dissolved oxygen and pH have stabilized. Parameters are considered stabilized when three or more sequential measurements are within  $\pm 0.2$  °C for temperature,  $\pm 3$  percent for conductivity,  $\pm 10$  percent for dissolved oxygen, and  $\pm 0.1$  unit for pH (EPA 1996). A groundwater sample will then be collected. If the stabilization parameters do not fall within the specified ranges after three well volumes have been purged, then a comment will be recorded on the data sheet that sample collection began after three well casing volumes were purged. If the well runs dry before the specified amount of purge water has been withdrawn, the well will be allowed to recharge for no more than twenty-four hours. After the well has recharged, one set of stabilization parameters will be measured and the well will be sampled.

#### **2.2.1.3 Groundwater Sample Collection**

This SAP proposes the use of low-flow sampling for wells that do not exhibit LNAPL contamination, and the use of a Solinst Model 425 discrete interval sampler (or equivalent) for wells where LNAPL has been observed. Low-flow sampling incorporates a low pumping rate that provides significant advantages over traditional high-rate purge or bailing sampling methods. Low-flow well purging and sampling minimizes water level drawdown and avoids aeration and disturbance of the water column in the well. Low-flow well purging and sampling will comply with procedures summarized in the April 18, 2005 SRS Low-Flow Purging and Sampling Guidelines, provided in Appendix B. The objective is to minimize physical and chemical changes to groundwater during sample collection. Reducing drawdown and aeration of the water column minimizes volatilization of chemicals that may be present in the aquifer.

Groundwater samples will be collected from monitoring wells following well development (newly installed wells) and purging (all wells), as follows:

- All monitoring wells will be purged and sampled using a bladder pump. Disposable bladders and tubing will be used in each well sampled. Water samples for laboratory analyses will be collected by disconnecting the down-hole tubing from the flow-through cell and collecting the sample. The pump discharge will be reduced to no greater than 0.5 liters per minute. VOC samples will be collected by allowing the pump discharge to flow gently down the inside of laboratory-supplied 40-milliliter (mL) volatile organic analysis (VOA) vials preserved with hydrochloric acid and chilled to maintain the sample temperature to below 4°C.
- Existing residential and industrial wells will be sampled from an outside spigot or tap closest to the well, prior to any in-line water treatment system (if possible).

One round of groundwater samples will be collected from all monitoring wells, residential wells, and industrial wells following the development and purging phase of the investigation. The need for future groundwater sampling will be evaluated, and may be performed under a separate task order if requested by DEQ.

#### **2.2.1.4 Soil Sampling**

This SAP proposes that surface and subsurface soil sampling will comply with procedures described in TTEMI amended SOP 005 (Appendix B). Surface soil samples will be collected using a hand corer and/or new disposable trowel to fill a 4-ounce (or larger) wide mouth glass jar, or half-gallon zip-lock bag, as appropriate (see Table 9). Subsurface soil samples will be collected from the soil core using a new disposable trowel to fill a 4-ounce (or larger) wide mouth glass jar, or half-gallon zip-lock bag, as appropriate (see Table 9).

#### **2.2.1.5 Surface Water Sampling**

Samples of surface water and sediment will be collocated, and will be analyzed as identified in Appendix F, Table F-1. Surface water and sediment sample locations are provided on Figure 5D. Water quality parameters will be measured at each sampling location using field sensor probes for pH, specific conductance, temperature, dissolved oxygen, oxidation reduction potential, and turbidity.

TABLE 9

## SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS

Parameter	Method Number <sup>a</sup>	Minimum Sample Volume	Sample Container	Preservative	Laboratory	Holding Time <sup>b</sup>
<b>Organic Analyses (Soil)</b>						
VOC	EPA 624/8260B	125 mL	Wide mouth glass - 4 oz.	Cool, 4 °C	E	14 days
SVOC (including PAHs)	EPA 8270C EPA 8270 SIM for PAHs	125 mL	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	14 days/40 days
PCP	EPA Method 8151A	125 mL	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	14 days/40 days
VPH	Massachusetts Method	125 mL	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	7 days/28 days
EPH	Massachusetts Method	125 mL	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	7 days/40 days
Dioxins and Furans	EPA 8290	50 g	Amber glass with Teflon®-lined lid	Cool, 4 °C	E	30 days/45 days
TOC	EPA 415.2/A5310C	100 g	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	14 days/28 days
PCB	SW 8082	125 mL	Amber wide mouth glass - 4 oz.	Cool, 4 °C	E	14 days/40 days
<b>Inorganic Analyses (Soil)</b>						
Metals	EPA 3050/6010B	125 mL	Wide mouth glass - 4 oz.	Cool, 4 °C	E	180 days; Hg: 28 days
<b>Other Analyses (Soil)</b>						
Bulk Density	MSA Part 4 Physical Methods, Method 2.1 (ASTM D2937)	1500 g	Known volume of soil (cylinder)	No preservation required	E	180 days
Specific Gravity (Particle Density)	MSA Part 4 Physical Methods, Method 2.2 (ASTM D854)	1500 g	Half-gallon zip-lock	No preservation required	E	180 days
Porosity	MSA Part 4 Physical Methods, Method 2.3.2.1	0 g	Calculated from Bulk Density and Particle Density	No preservation required	E	180 days
Particle Size Analysis	MSA Part 4 Physical Methods, Method 2.4 (ASTM D422)	1500 g	Half-gallon zip-lock	No preservation required	E	180 days
Moisture content	MSA Part 4 Physical Methods, Method 3.1.3.1 (ASTM D2216-98)	1500 g	Half-gallon zip-lock	No preservation required	E	180 days

**TABLE 9**  
**(Continued)**  
**SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS**

Parameter	Method Number <sup>a</sup>	Minimum Sample Volume	Sample Container	Preservative	Laboratory	Holding Time <sup>b</sup>
Soil pH	MSA Part 3 Chemical Methods, Method 16 (ASTM D4972-95a)	1500 g	Half-gallon zip-lock	Cool, 4 °C	Energy	As soon as possible
Complete TCLP (excluding pesticides and herbicides)	SW 3050, SW1311	500 g	Amber glass – 1 liter	Cool, 4 °C	Energy	14 days
Complete SPLP (excluding pesticides and herbicides)	SW 1312	500 g	Amber glass – 1 liter	Cool, 4 °C	Energy	14 days
<b>Organic Analyses (Water)</b>						
VOC	EPA 8260B	2 40-mL	Glass VOA vial with Teflon®-lined septum	To pH <2 with HCl; Cool, 4 °C	Energy	14 days
SVOC (including PAHs)	EPA 8270C EPA 8270 SIM for PAHs	2 1-Liter	Amber glass	Cool, 4 °C	Energy	7 days/40 days
PCP	EPA Method 8151A	2 1-Liter	Amber glass	Cool, 4 °C	Energy	7 days/40 days
VPH	Massachusetts Method	2 40-mL	Glass VOA vial with Teflon®-lined septum	To pH <2 with HCl; Cool, 4 °C	Energy	7 days/14 days
EPH	Massachusetts Method	2 1-Liter	Amber glass	To pH <2 with H <sub>2</sub> SO <sub>4</sub> ; Cool, 4 °C	Energy	14 days/40 days
Dioxins and Furans	EPA 8290	2 1-Liter	Amber glass with Teflon®-lined lid	Cool, 4 °C	Pace	30 days/45 days
Formaldehyde	NIOSH 3500 Mod.	100 mL	Amber glass	Cool, 4 °C	Energy	No requirements
<b>Inorganic Analyses (Water)</b>						
Metals <sup>c</sup>	EPA200.7/200.8/200.9 <sup>c</sup>	250 mL	Polyethylene (1 liter)	To pH <2 with HNO <sub>3</sub> ; Cool, 4 °C	Energy	180 days; Hg: 28 days
Chloride	EPA E300.0/A4500CLB	50 mL	Polyethylene	None	Energy	28 days
pH, specific conductance, temperature, dissolved oxygen, PID screen	Water quality meter, PID	Not applicable	Not applicable	Time sensitive	Energy	Analyze immediately in field
TOC	EPA 415.2/A 5310 C	125 mL	Amber glass	To pH <2 with HCl; Cool, 4 °C	Energy	28 days
Bromate	EPA 300.0 Mod.	100 mL	Amber glass	Cool, 4 °C	Energy	28 days

**TABLE 9**  
**(Continued)**  
**SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS**

**Notes:**

- <sup>a</sup> Complete method references are presented in Section 2.4
- <sup>b</sup> The first number (or number alone) refers to the maximum number of days from sampling to extraction and the second number refers to the maximum number of days from extraction to analysis.
- <sup>c</sup> Samples to be collected according to Technical Memorandum - Total metals analysis for groundwater samples (Appendix B).

<	Less than
ASTM	American Society for Testing Materials
°C	Degrees Celsius
Energy	Energy Laboratories - Helena
EPA	U.S. Environmental Protection Agency
g	Grams
HCl	Hydrochloric acid
Hg	Mercury
HNO <sub>3</sub>	Nitric acid
L	Liter
Laboratory	Destination laboratory for sample analyses
mL	Milliliter-
NIOSH	National Institute for Occupational Safety and Health
oz.	Ounce
ORP	Oxidation reduction potential
Pace	Pace Analytical - Minneapolis
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PID	Photoionization detector
SPLP	Synthetic precipitation leaching procedure
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TOC	Total organic carbon
USDA	United States Department of Agriculture
VOA	Volatile organic analysis
VOC	Volatile organic compound

Collocated surface water and sediment samples will be collected from the most downstream location to the farthest upstream sample location so that any sediment disturbances from samples collected upstream do not affect downstream sample locations. The following sequence of sampling activities will occur at each location:

- (1) A surface water sample will be collected.
- (2) Water quality parameters will be measured.
- (3) A sediment sample will be collected.
- (4) River stage will be measured, and the elevation tied to a known survey point.

Surface water samples will be collected as grab samples by directly immersing sample containers under the water surface near the river bank as described in TTEMI SOP 009 (Appendix B). This SAP does not propose measuring surface water flows in the Stillwater River.

#### **2.2.1.6 Surface Soil Sampling**

Sampling of surface soils will be conducted to evaluate the physical, chemical, and visual characteristics of soils at the KRY site (Figure 5A). Surface soil samples are also identified in Appendix F, Table F-1. All sampling will follow SOP 005 (Appendix B), and will be collected as a grab sample from a discrete location and depth using a hand corer. For this SAP, surface soils are obtained from a variety of soil horizons within the 0 to 2.0 foot bgs depth interval, including 0 to 2 inches, 0.0 to 0.5 ft, 0.5 to 1.0 ft, or 1.0 to 2.0 ft bgs. If the proposed sample is located in an area that is either (1) vegetated, or (2) contains duff or surface gravel, the organic material or gravel will first be removed and the sample will be collected immediately below this layer. A hand corer will then be driven to the appropriate depth(s): 0 to 2 inches, 0.0 to 0.5 ft, 0.5 to 1.0 ft, or 1.0 to 2.0 ft bgs. The core will then be removed from the sampler, and soil will be placed into an appropriate container using a new disposable trowel to fill the container (Table 9).



### **2.2.1.7 Sludge and Sediment Sampling**

#### Sludge Sampling

Samples of sludge and oily waste at the Reliance facility and vicinity will be collected as part of the surface soil investigation for this SAP (Figure 5A). Sample locations are identified in Appendix F, Table F-1. All sampling will follow SOP 006 using a new disposable hand trowel. Sludges and oily waste will be analyzed for TCLP and PCBs, in addition to other selected parameters as presented in Appendix F, Table F-1.

#### Sediment Sampling

Stream sediment samples will be collected as part of this SAP. All sampling will be conducted using a gravity corer, ponar (clam-shell) grab sampler, or other true sediment sampling device as outlined in SOP 006 (Appendix B), and the sampling location farthest downstream will be sampled first. Sediment samples collected in upstream and downstream locations will be obtained from slow-moving pools or eddies, where possible. In addition, the sediment samples will be collected at approximately the same location as the associated river water sample. Aqueous samples will be obtained first to avoid collecting suspended particles that may result from sediment sampling. To avoid disturbing an area to be sampled, sampling locations in streams will always be approached from the downstream side.

### **2.2.2 Decontamination**

The site is located in a zone controlled industrial area and cannot be secured. Exclusion zones will be established in areas where (1) soil borings are being drilled or (2) a well cap is open.

All personnel and equipment will go through decontamination procedures when leaving a contaminated area. Decontamination procedures will be used in conjunction with methods to prevent contamination including minimizing contact with wastes and maximizing worker production. All soil sampling and drilling equipment, including drill rods and bits, and the back end of the drill rig, will be steam cleaned before work begins. Decontamination of the drilling equipment will follow general practices listed in SOP 002 (Appendix B), with the exception that during sampling, all nondisposable field equipment will be decontaminated only once immediately prior to its next use. A portable steam cleaner and an onsite source of potable water will be used for decontamination, and all water derived from decontamination

will be collected and temporarily stored on site. An onsite source of potable water for the steam cleaner will be available. As yet, arrangements for an onsite source of potable water have not been made; however, it is anticipated that potable water will can be obtained by tapping into the existing water supply line at either the KPT facility or obtaining water from the Evergreen Water and Sewer District facility. Personnel will decontaminate all equipment before leaving the site to prevent offsite transport of contamination.

Equipment decontamination will consist of a tap water rinse, soap and water wash, a distilled water rinse, a methanol rinse, and air drying. Disposable equipment (such as hand trowels and tubing) or pump bladders will not need to be decontaminated.

### **2.2.3 Management of Investigation-Derived Waste**

A substantial quantity of IDW will be generated during this investigation. Solid matrix IDW will include drill cuttings, the remainder of homogenized soil from sampling, disposable equipment, and disposable PPE. Liquid matrix IDW will include wastewater from decontamination procedures, monitoring well development and purging, aquifer testing, and preparation of equipment rinsate samples.

#### **Solid Matrix IDW**

Soil cuttings and other solid matrix IDW will be temporarily stored in 55-gallon drums on site, and the associated soil sample identification numbers will be marked on each drum using an indelible ink pen. Once received, soil analytical data will be used to segregate IDW soil into two groups that include (1) drums that contain soil that exhibit detectable concentrations of a RCRA listed waste, and (2) drums that contain soil that do not exhibit detectable concentrations of a RCRA listed waste. Segregated soil cuttings and other solid matrix IDW from each group will be subsequently transferred to larger roll-off bins and continue to be segregated. Empty drums will be cleaned and reused, recycled, or disposed of properly at a licensed offsite facility.

An estimated 5,800 cubic ft (214.8 cubic yards) of solid matrix IDW will be generated. This is an equivalent volume equal to about fifteen 15-cubic yard roll-off bins. One composite IDW soil sample will be obtained from each of the 15 roll-off bins. IDW soil samples from roll-off bins will be analyzed for PCP, VOCs, SVOCs (including PAHs), dioxins and furans, chlorinated and nonchlorinated pesticides, chlorinated herbicides, pH, ignitability, reactivity, and metals. All soil from roll-off bins that is shown to

contain RCRA wastes will be incinerated off site. Soil from roll-off bins that do not contain RCRA waste will be disposed of at the local landfill, if possible. If landfill disposal for this waste is not an option, then other arrangements for soil disposal will be coordinated with DEQ/RD. DEQ is responsible for signing all manifests related to disposal of IDW.

### **Liquid Matrix IDW**

An estimated 21,000 gallons of IDW wastewater will be generated during this investigation. IDW wastewater will be temporarily stored in drums, transferred to onsite 500-gallon (or larger) Baker tanks, and then treated onsite using a granulated activated carbon (GAC) filter, and further treatment using ozonation technology. One composite IDW water sample per 500 gallons of treated water will be sent to the laboratory for the following analyses: PCP, VOCs, SVOCs (including PAHs), dioxins and furans, chlorinated and nonchlorinated pesticides, chlorinated herbicides, pH, flash point, and metals. Liquid matrix IDW will be characterized as a hazardous waste if (1) PCP is present in IDW at a concentration greater than 1 microgram per liter ( $\mu\text{g/L}$ ), or (2) the concentration of any parameter exceeds the toxicity characteristic leaching procedure (TCLP) maximum concentration listed in Table 1 of the CFR at 40 CFR 261.24. After the IDW water sample is analyzed and results are received, treated water meeting State standards will be land applied at a noncontaminated area on site. A proper staging area for temporary storage of IDW and the GAC and ozonation units will be identified by TTEMI for approval by the DEQ/RD.

#### **2.2.4 Sample Containers and Holding Times**

The type of sample containers to be used for each analysis, the sample volumes required, the preservation requirements, and the maximum holding times for sample extraction and analysis are presented in Table 9.

### **2.3 SAMPLE HANDLING AND CUSTODY**

The following subsections describe sample handling procedures, including sample identification and labeling, documentation, chain-of-custody, and shipping.

### 2.3.1 Sample Identification

A unique sample identification number will be assigned to each sample collected at the KRY site. The sample identification numbering system is designed to be compatible with the TTEMI computerized data management system that includes results from previous investigations conducted at the KRY site. The sample numbering system allows each sample to be uniquely identified, and provides a means of tracking the sample from collection through analysis.

Each sample will be assigned a 12-digit alpha-numeric identification number, where the first alpha characters (QQ) indicate the station type, the second three numeric characters (XXX) identify the station number, the next alpha character (W) identifies the well completion depth, and the last three numeric characters (DZZ) designates a sample number, where D equal to 9 is a field duplicate.

<u>Station Type</u>	<u>Station Number</u>	<u>Sample Number</u>
QQ	KRYXXXW	DZZ

Possible station types (QQ) include:

- SB – Soil Boring
- MW – Monitoring well
- SS – Surface Soil
- SE – Sediment
- SW – Surface Water
- SL – Sludge
- OT – Other

The field quality control (QC) samples for this investigation include equipment rinsate blanks, source water blanks, and trip blanks. For quality control samples, the station types include:

- QE – Equipment rinsate blank
- QS – Source water blank
- QT – Trip blank

Unique station numbers (XXXW) will be assigned for newly proposed KRY site stations, as follows.

- KRY groundwater stations: KRY100 through KRY199

The well completion depth (W) pertains to groundwater samples only, and includes:

A – Designation for a new shallow water table monitoring well in the unconfined aquifer

B – Designation for a new deep unconfined aquifer monitoring well

C – Designation for a new confined aquifer monitoring well

- KRY surface water stations: KRY200 through KRY299
- KRY sediment stations: KRY300 through KRY399
- KRY surface soil stations: KRY400 through KRY599
- KRY subsurface soil stations: KRY600 through KRY799
- KRY IDW samples: KRY800 through KRY899

Existing groundwater monitoring wells, industrial wells and residential wells will be sampled as part of this investigation. Station numbers for these existing wells will retain the monitoring well number previously assigned.

The sample number (DZZ) for groundwater samples pertains to the sample event. For example, for the first round of groundwater sampling conducted as part of this SAP, the sample number (DZZ) is 001 (field duplicate is 901). For the next subsequent round of sampling (if conducted), the sample number (DZZ) would be 002 (field duplicate is 902).

The sample number (DZZ) for all soil samples pertains to the specific depth interval sampled, and is numbered sequentially from the surface to the deepest sample interval at a specific sample point. For example, if three subsurface soil samples are collected from a single soil boring, the shallowest sample is assigned a sample number (DZZ) of 001, the next deepest sample is assigned a sample number (DZZ) of 002, and the deepest sample is assigned a sample number (DZZ) of 003.

Therefore:

- The groundwater sample collected during the first round of sampling at newly proposed water table monitoring well KRY-123A would be designated as MWKRY123A001. The field duplicate for this sample would be MWKRY123A901.
- The groundwater sample collected during the first round of sampling as part of this SAP by TTEMI at existing monitoring well GWRR-9 would be designated as MWGWRR9001. The field duplicate for this sample would be MWGWRR9901.

- The subsurface sample collected from the 4 to 6 ft bgs depth interval at soil boring location KRY-623 would be designated as SBKRY623002 (assuming there was one shallower sample interval from this same borehole). The next deepest sample from this borehole (8 to 10 ft bgs) would be designated SBKRY623003.
- The three surface soil samples (0 to 0.5 ft bgs, 0.5 to 1 ft bgs, and 1 to 2 ft bgs) collected at surface soil location KRY-405 would be designated SSKRY405001, SSKRY405002, and SSKRY405003, respectively.

The sample identification numbers for all field QC samples will be the consecutive sample number. For example, KRYQT001 will be assigned to the first trip blank collected during the field QC event.

KRYQE001 will be assigned to the first equipment rinsate collected, and KRYQS001 will be assigned to the first source water blank collected.

### **2.3.2 Sample Labels**

A sample label will be affixed to all sample containers either by the laboratory prior to shipping containers to the site, or in the field by TTEMI personnel. The label will be completed with the following information written in indelible ink:

- Project name and location,
- Sample identification number,
- Date and time of sample collection,
- Preservative used,
- Sample collector's initials, and
- Analysis required.

After it is labeled, each soil sample will be refrigerated or placed in a cooler that contains ice to maintain the sample temperature of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

### **2.3.3 Sample Documentation**

Documentation during sampling is essential to ensure proper sample identification. TTEMI personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in permanent black ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.

- Any serialized documents will be maintained at TTEMI and referenced in the site logbook.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

Section 1.6.1 includes additional information on how TTEMI will use logbooks to document field activities. The TTEMI field team leader is responsible for ensuring that sampling activities are properly documented.

#### **2.3.4 Chain of Custody**

TTEMI will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- The sample is in a person's physical possession or view.
- The sample is in a secure area with restricted access.
- The sample is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

Chain-of-custody procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The chain-of-custody record (see Appendix C) also will be used to document all samples collected and the analysis requested. Information that the field personnel will record on the chain-of-custody record includes:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer

- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the chain-of-custody record will be crossed out and initialed. Chain-of-custody records that are initiated in the field will be signed by field personnel and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the chain-of-custody record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory chain of custody begins with sample receipt and continues until samples are discarded. Analytical laboratories must follow custody procedures at least as stringent as are required by the EPA CLP SOWs (EPA 1999a, 2000a). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons delivering the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. Once the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples requiring special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

### **2.3.5 Sample Shipment**

Sample shipment will follow SOP 019 (Appendix B). In general, the following procedures will be implemented when shipping all soil and water samples collected during this project:

- The cooler will be filled with bubble wrap, sample bottles, and packing material. Sufficient packing material will be used to prevent sample containers from breaking during shipment. Enough ice will be added to maintain the sample temperature at or below  $4 \pm 2^{\circ}\text{C}$ .



- The chain-of-custody records will be placed inside a plastic bag. The bag will be sealed and taped to the inside of the cooler lid. The air bill, if required, will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the sampler suspects that the sample contains any substance that would require laboratory personnel to take safety precautions.
- The cooler will be closed and taped shut with strapping tape around both ends. If the cooler has a drain, it will be taped shut both inside and outside of the cooler.
- Signed and dated custody seals will be placed on the front and side of each cooler. Wide clear tape will be placed over the seals to prevent accidental breakage.
- The chain-of-custody record will be transported within the taped sealed cooler. When the cooler is received at the analytical laboratory, laboratory personnel will open the cooler and sign the chain-of-custody record to document transfer of samples.

Multiple coolers may be sent in one shipment to the laboratory. The outside of the coolers will be marked to indicate the number of coolers in the shipment.

## 2.4 ANALYTICAL METHODS

Table 9 presents the analytical methods that will be used to analyze samples collected during the field activities at the KRY site. Appendix A presents the project QA objectives and control limits for sample analyses established as part of the DQO process (Section 1.3). Tables D-2 and D-3 in Appendix D present the individual target analytes required for this investigation and their associated PRRLs. The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. If problems occur in achieving the PRRLs, the laboratories will contact the TTEMI analytical coordinator immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing nontarget compound peaks to go off scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the MDL will be reported with appropriate flags to indicate the greater uncertainty associated with these values.

In this SAP, the “standard suite” of analytes is defined as follows:

### **Liquid matrix analyses:**

- PCP: By EPA Method 8151A (or equivalent), detection limit 0.1 µg/L.
- EPH/VPH: By Massachusetts Method, DEQ guidance dated October, 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 300 µg/L total EPH will be subjected to EPH fractionation.
- VOC: By Method 8260B, detection limit generally 0.5 µg/L.

SVOC: By EPA Method 8270C (PAHs by 8270 SIM), detection limit generally 10 µg/L.  
Chloride: By EPA E300.0/A4500CLB

**Solid matrix analyses:**

PCP: By EPA Method 8151A (or equivalent), detection limit 0.002 mg/kg.  
EPH/VPH: By Massachusetts Method, DEQ guidance dated October 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 50 mg/kg total EPH will be subjected to EPH fractionation.  
VOC: By Method 8260B, detection limit generally 0.2 mg/kg.  
SVOC: By EPA Method 8270C (PAHs by 8270 SIM), detection limit generally 0.33 mg/kg.

In addition to the standard suite of analyses, selected samples will also be analyzed for one or more of the following constituents to satisfy various investigation objectives described in this SAP: dioxins and furans, metals (including tetraethyl lead), SPLP, TCLP, PCBs, bromate, formaldehyde, and various soil physical parameters. Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and quality assurance and quality control (QA/QC) requirements are presented in the following subsections.

**2.4.1 Selection of Analytical Laboratory**

Energy Laboratories, Inc. will conduct the majority of all water and soils analyses. The analytical laboratory project manager and point of contact is Mr. Bill Brown. The mailing address, shipping address, and appropriate telephone numbers for Energy Laboratories are:

**Mailing Address**

Energy Laboratories, Inc.  
P.O. Box 30916  
Billings, MT 59107

**Shipping Address for Samples**

Energy Laboratories, Inc.  
3161 East Lyndale Avenue  
Helena, MT 59601

Voice: (406) 252-6325 or 1-800-735-4489  
Fax: (406) 252-6069  
Email: [bbrown@energylab.com](mailto:bbrown@energylab.com)  
Internet: [www.energylab.com](http://www.energylab.com)

Pace Analytical Services, Inc. will conduct low-level dioxin and furan water and soil analyses. The mailing address, shipping address, and appropriate telephone numbers for Pace Analytical Services, Inc. are:

**Mailing and Shipping Address**

Pace Analytical  
1700 Elm Street, Suite 200  
Minneapolis, MN 55414

**Technical Contact**

Scott Unze  
Pace Analytical Services, Inc.  
1700 Elm St. Suite 200, Minneapolis, MN 55414  
E-mail: Scott.Unze@pacelabs.com  
Phone: (612) 607-6383 • Fax: (612) 607-6444

Prior to commencement of fieldwork, Energy laboratories will have a direct contract with DEQ/RD in place; therefore, there will be no need for TTEMI to procure a subcontract with this vendor.

The TTEMI analytical coordinator will hold a kickoff meeting with the laboratory project manager. The TTEMI project manager, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

In addition, the TTEMI analytical coordinator will contact all appropriate laboratories at least one week prior to the sampling event to arrange for appropriate sample supplies such as jars and bottles, sample drop off at the end of each sample collection day, and appropriate analysis turn-around time.

#### **2.4.2 Project Analytical Requirements**

For this investigation, only two prequalified subcontractor laboratories (Energy Laboratories, Inc., and Pace Analytical) will conduct offsite analysis of soil and water samples. The majority of analytical methods selected for the KRY site investigation are standard EPA methods that have been previously identified by the DEQ/RD; others such as EPH/VPH are not. In addition, analytical methods used in this investigation may differ from analytical methods used in previous phases of the investigation at the KRY site in that they provide lower MDLs.

The analytical methods required for this investigation include the following:

### **Liquid Matrix Samples**

PCP:	By EPA Method 8151A
EPH/VPH:	By Massachusetts Method, DEQ guidance dated October 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 300 µg/L total EPH will be subjected to EPH fractionation.
VOC:	By EPA 8260B
SVOC:	By EPA Method 8270C (PAHs by 8270 SIM)
Metals:	By EPA Method 200.7/200.8/200.9
Dioxins and furans:	By EPA Method 8290
TOC:	By EPA Method 415.2/A5310C
Chloride:	By EPA Method E300.0/A4500CLB
Bromate:	By EPA 300.0 Mod.
Formaldehyde:	By EPA 8315 Mod.

### **Solid Matrix Samples**

PCP:	By EPA Method 8151A
EPH/VPH:	By Massachusetts Method, DEQ guidance dated October 2003. VPH will be performed separately from EPH. EPH screen will be performed, initially. Samples greater than 50 mg/kg total EPH will be subjected to EPH fractionation.
VOC:	By EPA Method 8260B
SVOC:	By EPA Method 8270C (PAHs by 8270 SIM)
Metals:	By EPA Method 3050/6010B
Dioxins and furans:	By EPA Method 8290
TOC:	By EPA Method 415.2/A5310C
TCLP:	By SW1311
SPLP:	By SW1312
PCB:	By SW8082

This SAP documents project-specific QC requirements for the selected analytical methods. Sample volume, preservation, and holding time requirements are specified in Table 9. Requirements for laboratory QC samples are described in Table 4, and in Section 2.5. Appendix A includes project-specific precision and accuracy goals for the methods. Finally, PRRLs for each method are documented in Appendix D, Tables D-2 and D-3.

## **2.5 QUALITY CONTROL**

TTEMI will assess the quality of field data through regular collection and analysis of field QC samples. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures and analyses are conducted properly and that the quality of the data is known.

### 2.5.1 Field Quality Control Samples

QC samples are collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. Table 10 provides a summary of the types and frequency of collection of field QC samples.

**TABLE 10**  
**FIELD QC SAMPLES**

Sample Type	Frequency of Analysis <sup>a</sup>	Matrix
Matrix spike and matrix spike duplicate	5 percent <sup>b</sup>	Soil/Water
Field duplicate	5 percent	Water
Source water blank (deionized water)	5 percent	Soil/Water
Trip blank (VOC samples only)	5 percent	Soil/Water
Equipment Rinsate blank	5 percent	Soil <sup>c</sup> /Water

**Notes:**

- a Field QC samples will not be submitted for IDW samples.
  - b MS and MSDs for soil samples will be selected by the laboratory. Matrix duplicates replace MSDs for inorganic analyses.
  - c Pertains to rinsate collected after decon of split spoon or roto sonic core is complete. An equipment blank can also be collected at the request of DEQ, per DEQ low-flow sampling guidance (Appendix B).
- VOC Volatile organic compound

#### 2.5.1.1 Field Duplicates

Field duplicate samples are collected at the same time and from the same source and then submitted as separate samples to the laboratory for analysis. Field duplicates will be collected at a frequency of 5 percent for water samples. Duplicate samples will be assigned a unique sample identification number that does not obviously indicate that it is a duplicate.

Although field duplicate soil samples are sometimes collected as soil samples from adjacent locations, such soil duplicate samples will not be collected for this project for two reasons. First, since adjacent soil samples incorporate some spatial variability, these samples cannot be used directly to assess sampling

precision. Second, it is not practical to set QC limits for the RPD of such samples, which precludes the use of these samples for QC purposes.

#### **2.5.1.2 Source Water Blanks and Trip Blanks**

Contamination can be introduced from many external sources during collection of field samples, including water used in the decontamination process. Source water blanks (water used for decontamination) will be prepared by the field team at a frequency of 1 per 20 samples (5 percent) to assess potential external sources of contamination. Analytically certified, organic-free, high performance liquid chromatography-grade water or equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters. Trip Blanks (similar to source water blanks but specific to VOC analyses) will be previously prepared by the laboratory in 40 mL VOA bottles, and will be returned to the laboratory for VOC analysis [frequency of 1 per 20 samples (5 percent)].

If any contaminant is present in the blank samples above the MDL, the result for associated field samples that contain the same contaminant will be qualified as potentially not detected if the concentration of the field sample is less than five times the concentration found in the blank. The same criterion applies to the presence of the following common laboratory contaminants when they are present in the associated field sample at less than 10 times the concentration found in the blank sample: methylene chloride, acetone, 2-butanone, and phthalate esters.

#### **2.5.1.3 Equipment Rinsate Samples**

Equipment rinsate samples demonstrate whether decontamination procedures are effective in removing contaminants from the field sampling equipment. The presence of contamination in equipment rinsate samples indicates that cleaning procedures were not effective, allowing for the possibility of cross-contamination. Equipment rinsate samples will be collected during soil and water sampling at a frequency of 5 percent. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the decontaminated sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free, high performance liquid chromatography-grade water or equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

Equipment rinsate samples will be sent to the laboratory. During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

## **2.5.2 Laboratory Quality Control Samples**

Laboratory QC samples are prepared and analyzed at the laboratory to evaluate the effectiveness of sample preparation and analysis and to assess analytical precision and accuracy. The types of laboratory QC samples that will be used for this project are discussed in the following sections. Table 4 presents the required frequencies for laboratory QC samples, and Appendix A presents project-specific precision and accuracy goals for these samples.

### **2.5.2.1 Matrix Spike and Matrix Spike Duplicates**

MS/MSD samples require the collection of an additional volume of material for laboratory spiking and analysis. MS/MSD samples will be collected at a frequency of 5 percent for soil and water. Matrix spike samples measure the efficiency of all the steps in the analytical method in recovering target analytes from an environmental matrix. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The RPD between spiked samples will be calculated to evaluate precision. Project-specific precision and accuracy goals are presented in Appendix A.

### **2.5.2.2 Method Blanks**

Method blanks are prepared to evaluate whether contamination is originating from the reagents used in sample handling, preparation, or analysis. They are critical in distinguishing between low-level field contamination and laboratory contamination. A method blank consists of laboratory analyte-free water and all of the reagents used in the analytical procedure. It is prepared for every analysis in the same manner as a field sample and is processed through all of the analytical steps. Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

### **2.5.2.3 Laboratory Control Samples or Blank Spikes**

A laboratory control sample (LCS), or blank spike, originates in the laboratory as deionized or distilled water that has been spiked with standard reference materials of a known concentration. An LCS is analyzed to verify the accuracy of the calibration standards. These internal QC samples are also used to evaluate laboratory accuracy in the presence of matrix interference for field samples. LCSs are processed through the same analytical procedure as field samples. LCSs will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to gauge the usability of the data.

### **2.5.2.4 Surrogate Standards**

Surrogate standards consist of known concentrations of nontarget organic analytes that are added to each sample, method blank, and MS/MSD before samples are prepared and analyzed. The surrogate standard measures the efficiency of the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed for volatile and extractable organic constituents. Surrogate compounds are used in the analysis of VOCs to monitor purge efficiency and analytical performance, whereas surrogates are used in the analysis of extractable organic compounds to monitor the extraction process and analytical performance.

Factors such as matrix interference and high concentrations of analytes may affect surrogate recoveries. The effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems. Laboratory personnel are required to re-extract (when applicable) and re-analyze samples when associated surrogates are outside of control limits. Data from both analyses of the samples in question are reported.

During validation, data will be qualified as estimated for any result that fails to meet surrogate criteria. SVOC data will be qualified as estimated if two or more surrogates from each fraction (base/neutral and acid) are outside the control limits. The table in Appendix A provides the guidelines for surrogate recovery for analyses that are planned for this project.



#### **2.5.2.5 Internal Standards**

Internal standards are compounds that are added to every VOC and SVOC standard, method blank, MS/MSD, and sample or sample extract at a known concentration prior to analysis. Internal standards are used as the basis for quantification of gas chromatograph/mass spectrometer (GC/MS) target compounds and ensure that the GC/MS sensitivity and response are stable during the analytical run. An internal standard is used to evaluate the efficiency of the sample introduction process and monitors the efficiency of the analytical procedure for each sample matrix encountered. Internal standards are also used in the analysis of organic compounds by GC to monitor retention-time shifts. Validation of internal standards data will be based on EPA protocols presented in guidelines for evaluating organic analyses (EPA 1999b).

#### **2.5.3 Additional Laboratory Quality Control Procedures**

In addition to the analysis of laboratory QC samples, subcontractor laboratories will conduct the QC procedures discussed in the following sections.

##### **2.5.3.1 Method Detection Limit Studies**

The MDL is the minimum concentration of a compound that can be measured and reported. The MDL is a specified limit at which there is 99 percent confidence that the concentration of the analyte is greater than zero. The MDL takes into account sample matrix and preparation. The subcontractor laboratory will demonstrate the MDLs for all analyses except inorganic analyses and physical properties test methods. MDL studies will be conducted annually for soil matrices, or more frequently if any method or instrumentation changes. Each MDL study will consist of seven replicates spiked with all target analytes of interest at concentrations no greater than required quantitation limits. The replicates will be extracted and analyzed in the same manner as routine samples. If multiple instruments are used, each will be included in the MDL study. The MDLs reported will be representative of the least sensitive instrument.

##### **2.5.3.2 Sample Quantitation Limits**

Sample quantitation limits (SQL) are also referred to as practical quantitation limits. The LRRLs presented in Appendix D are chemical-specific levels that a laboratory should be able to routinely detect and quantify in a given sample matrix. The LRRL is usually defined in the analytical method or in laboratory method documentation. The SQL takes into account changes in the preparation and analytical

methodology that may alter the ability to detect an analyte, including changes such as use of a smaller sample aliquot or dilution of the sample extract. Physical characteristics such as sample matrix and percent moisture that may alter the ability to detect the analyte are also considered. The laboratory will calculate and report SQLs for all environmental samples.

### **2.5.3.3 Control Charts**

Control charts document data quality in graphic form for specific method parameters such as surrogates and blank spike recoveries. A collection of data points for each parameter is used to statistically calculate means and control limits for a given analytical method. This information is useful in determining whether analytical measurement systems are in control. In addition, control charts provide information about trends over time in specific analytical and preparation methodologies. Although they are not required, TTEMI recommends that subcontractor laboratories maintain control charts for organic and inorganic analyses. At a minimum, method-blank surrogate recoveries and blank spike recoveries should be charted for all organic methods. Blank spike recoveries should be charted for inorganic methods. Control charts should be updated monthly.

## **2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

### **2.6.1 Maintenance of Field Equipment**

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in (1) the equipment manufacturer's literature or operating manual, or (2) SOPs that describe equipment operation associated with particular applications of the instrument. However, more stringent testing, inspection, and maintenance procedures and schedules may be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The field team leader will be notified of equipment malfunctions so that prompt service can be completed quickly or substitute equipment can be obtained. When equipment condition is suspect, unscheduled

testing, inspection, and maintenance should be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

### **2.6.2 Maintenance of Laboratory Equipment**

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected at the KRY site. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will include equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written SOPs will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions should be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

## **2.7 INSTRUMENT CALIBRATION AND FREQUENCY**

The following sections discuss calibration procedures that will be followed to ensure the accuracy of measurements made using field and laboratory equipment.

### **2.7.1 Calibration of Field Equipment**

Field equipment will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are

available from the specific manufacturers' instruction manuals, and general guidelines are included in SOPs. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference.

### **2.7.2 Calibration of Laboratory Equipment**

The laboratory will obtain calibration standards from the EPA repository or commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate parameters and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

## **2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

TTEMI project managers have primary responsibility for identifying the types and quantities of supplies and consumables needed to complete all projects, and are also responsible for determining acceptance criteria for these items.

Supplies and consumables can be received either at a TTEMI office or at a work site. When supplies are received at an office, the project manager or field team leader will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the TTEMI project manager or field team leader will inspect all items against the acceptance criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

The analytical laboratory is required to provide certified clean containers for all analyses. These containers must meet EPA standards described in “Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers” (EPA 1992b).

## **2.9 DATA MANAGEMENT**

Field and analytical data collected from this project are critical to site characterization efforts, development of the comprehensive conceptual site model, risk assessments, and selection of remedial actions to protect human health and the environment. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into TTEMI’s database for the KRY site. The electronic data will be used for preparing reports, tables, and creating graphic figures with geographic information systems (GIS) and computer-aided drafting (CAD). The following sections describe TTEMI’s data tracking procedures, data pathways, and overall data management strategy.

### **2.9.1 Data Pathways**

All new data that are generated in support of the KRY site project are tracked through a database created by TTEMI. Data are generated from two primary pathways at the KRY site: data derived from field activities and validated laboratory data. Data from these pathways will be entered into the database.

- Data generated during field activities are recorded using field forms (Appendix C). These forms are reviewed for completeness and accuracy by the analytical coordinator or field team leader. Data from the field forms are entered into the database.
- Data generated during laboratory analysis are recorded in hardcopy and in EDDs after the samples have been analyzed. The laboratories (Energy Laboratories and Pace Analytical) will send the hardcopy and EDDs records to the analytical coordinator, who reviews the data deliverable for completeness, accuracy, and format. The data will then be validated and reviewed, and finally loaded into the KRY site database with the appropriate data qualifiers. Data will be provided to DEQ so that results letters can be provided to residents and other property owners whose property was sampled during the investigation.

### **2.9.2 Data Management Strategy**

During the data collection phase of the project, the database will be updated with data as they are returned from the data validation process. The database can be used to generate reports in tabular format or figures using available computer-aided drafting and design and contouring software. The database will be used to provide data for chemical and geologic analyses, and for preparing reports and presentation graphics. Hard copies of forms, data, and chain-of-custody forms are filed in a secure storage area according to project and document control numbers. Laboratory data packages and reports will be archived at TTEMI and DEQ/RD. Laboratories that generated the data will also archive hard-copy data.

## **3.0 ASSESSMENT AND OVERSIGHT**

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to TTEMI and DEQ/RD management.

### **3.1 ASSESSMENT AND RESPONSE ACTIONS**

TTEMI and the DEQ/RD will oversee environmental data collection using the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes the types of assessments that may be completed, TTEMI and DEQ/RD responsibilities for conducting the assessments, and corrective action procedures to address problems identified during an assessment.

#### **3.1.1 Field Assessments**

TTEMI conducts field assessments to support data quality and encourages continuous improvement in the systems that support environmental data collection. Technical systems audits (TSA) are the type of field assessment most frequently conducted. TTEMI personnel conducting TSAs use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in the approved SAP are being implemented. Specific items that may be observed during the TSA include:

- Availability of project plans such as the SAP and HSP,
- Documentation of personnel qualifications and training,
- Sample collection, identification, preservation, handling, and shipping procedures,
- Sampling equipment decontamination,
- Equipment calibration and maintenance,
- Completeness of logbooks and other field records (including nonconformance documentation), and
- Health and safety procedures.

During the TSA, the lead TTEMI assessor verbally communicates any significant deficiencies to the field team leader for immediate correction.

The TTEMI project manager determines the frequency and duration of TSAs. Generally, TSAs are conducted early in the project so that any quality issues can be resolved before large amounts of data are collected. The TTEMI project manager will notify the DEQ/RD before a TSA is conducted so that they may attend the TSA and observe the field assessment. The DEQ/RD may also independently conduct a field assessment of any TTEMI project. Items reviewed by the DEQ/RD officer during a field assessment would be similar to those described above.

### **3.1.2 Field Corrective Action Procedures**

Field corrective action procedures will depend on the type and severity of the finding. TTEMI classifies assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described in Section 3.1.1, project teams are required to respond to deficiencies identified in TSA reports. The project manager, field team leader, and DEQ/RD will meet to discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed,
- Assigning responsibility for problem investigation and documentation,

- Selecting the corrective action to eliminate the problem,
- Developing a schedule for completing the corrective action,
- Assigning responsibility for implementing the corrective action,
- Documenting and verifying that the corrective action has eliminated the problem, and
- Notifying the DEQ/RD of the problem and the corrective action taken.

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for determining and implementing the corrective action, and the completion dates for each corrective action. The project manager will use a status report to monitor the status of all corrective actions.

The TTEMI project manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The project manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The project manager can also request the reanalysis of any or all data acquired since the system was last in control.

### **3.1.3 Laboratory Corrective Action Procedures**

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method QC requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the TTEMI analytical coordinator within two working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the TTEMI analytical coordinator. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

## **3.2 REPORTS TO MANAGEMENT**

Effective management of environmental data collection requires (1) timely assessment and review of all activities and (2) open communication, interaction, and feedback among all project participants. TTEMI will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.



### **3.2.1 Daily Progress Reports**

TTEMI will prepare a weekly progress report to summarize activities throughout the field investigation. A daily progress report may be prepared for issues that need to be communicated on a more immediate basis. This report will describe sampling and field measurements, equipment used, TTEMI and subcontractor personnel on site, QA/QC and health and safety activities, problems encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The progress report is prepared by the field team leader and submitted to the project manager.

### **3.2.2 Project Monthly Status Report**

The TTEMI project manager will prepare an MSR to be submitted to the DEQ/RD. MSRs address project-specific quality issues and facilitate their timely communication. The MSR will include the following quality-related information:

- Project status,
- Instrument, equipment, or procedural problems that affect quality and recommended solutions,
- Objectives from the previous report that were achieved,
- Objectives from the previous report that were not achieved, and
- Work planned for the next month.

If appropriate, TTEMI will obtain similar information from subcontractors participating in the project and will incorporate the information within the MSR.

## **4.0 DATA VALIDATION AND USABILITY**

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet DQOs for the project.

## **4.1 DATA REVIEW, VERIFICATION, AND VALIDATION**

Validation and verification of the data generated during field and laboratory activities are essential to obtaining data of defensible and acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

### **4.1.1 Field Data Verification**

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called “outliers.” A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

### **4.1.2 Laboratory Data Verification**

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any nonconformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

### **4.1.3 Laboratory Data Validation**

An independent third-party contractor will validate all laboratory data in accordance with current EPA national functional guidelines (EPA 1994, 1999b). DEQ/RD's goal is to obtain Level III data from the analytical laboratories, and has requested that full data validation not be conducted for all SDGs. Instead, DEQ proposes that cursory data validation be conducted for all samples. Requirements for data validation are listed below.

#### **4.1.3.1 Full Data Validation**

Full validation will be completed on full data packages for analysis of soil and water. The data reviewer is required to notify TTEMI and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. Data summary packages will consist of sample results, QC summaries, and all raw data associated with the sample results and QC summaries.

#### **4.1.3.2 Cursory Data Validation**

If requested by DEQ/RD, cursory validation can instead be completed on the summary data packages for analysis of soil and water samples. The data reviewer is required to notify TTEMI and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. Data summary packages will consist of sample results and QC summaries, including calibration and internal standard data.

#### **4.1.3.3 Data Validation Criteria**

Table 11 lists the QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from Table 11 will be consistent with the project-specific analytical methods listed in Section 2.4 of the SAP.

**TABLE 11**  
**DATA VALIDATION CRITERIA**

<b>Analytical Parameter Group</b>	<b>Cursory Data Validation Criteria</b>	<b>Full Data Validation Criteria</b>
CLP Organic Analyses	Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Field duplicate sample analysis Overall assessment of data for an SDG	Holding times Gas Chromatography/Mass Spectroscopy tuning Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Field duplicate sample analysis Compound identification Target compound list identification Compound quantitation and reported detection limits Tentatively identified compounds System performance Overall assessment of data for an SDG
CLP Inorganic Analyses	Holding times Calibration Blanks Matrix spike recovery Matrix duplicate sample analysis Laboratory control sample or blank spike Field duplicate sample analysis ICP serial dilution Overall assessment of data for an SDG	Holding times Calibration Blanks ICP interference check sample Matrix spike recovery Matrix duplicate sample analysis Laboratory control sample Field duplicate sample analysis Graphite furnace atomic absorption QC Sample result verification ICP serial dilution Detection limits Overall assessment of data for an SDG
Non-CLP Organic Analyses	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Field duplicate sample analysis Compound identification Detection limits Compound quantitation Sample results verification Other laboratory QC specified by the method Overall assessment of data for an SDG

**TABLE 11 (Continued)**  
**DATA VALIDATION CRITERIA**

<b>Analytical Parameter Group</b>	<b>Cursory Data Validation Criteria</b>	<b>Full Data Validation Criteria</b>
Non-CLP Inorganic and Physical Analyses	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Field duplicate sample analysis Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample Field duplicate sample analysis Other laboratory QC specified by the method Detection limits Analyte identification Analyte quantitation Sample results verification Overall assessment of data for an SDG

Notes:

CLP     Contract Laboratory Program  
ICP     Inductively Coupled Plasma  
SDG     Sample Delivery Group  
QC     Quality Control

## **4.2 RECONCILIATION WITH USER REQUIREMENTS**

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in Section 4.1, the data must be further evaluated to determine whether DQOs have been met. To the extent possible, TTEMI will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's "Guidance for Data Quality Assessment, Practical Methods for Data Analysis" (2000c). The DQA process includes five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative in nature, TTEMI may systematically assess data quality and data usability. This assessment would include:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (defined in Section 1.3.2) to determine whether acceptance criteria have been met
- A review of project-specific DQOs to determine whether they have been achieved by the data collected
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The KRY site final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

## REFERENCES

- Montana Department of Environmental Quality (DEQ). 2002. Final Voluntary Cleanup and Redevelopment Act Application Guide. August. On-line at:  
[http://deq.mt.gov/StateSuperfund/VCRA\\_Guide/FinalVCRAguide.pdf](http://deq.mt.gov/StateSuperfund/VCRA_Guide/FinalVCRAguide.pdf).
- DEQ. 2005. Action level for Arsenic in Surface Soil. April.
- DEQ/Planning, Prevention, and Assistance Division. 2006. Montana Numeric Water Quality Standards (DEQ-7). January.
- Pioneer Technical Services, Inc. (PTS). 2000. Final Phase I Remedial Investigation Report for the Reliance Refinery Site, Kalispell, Montana. December.
- Remediation Technologies, Inc. (RETEC). 1995. Site Investigation Report for Kalispell Pole and Timber, Kalispell, Montana. Unpublished report prepared for Burlington Northern Railroad. July.
- Tetra Tech EM Inc. (TTEMI). 2006. "Final Data Summary Report for the KPT, Reliance and Yale Oil Facilities". January 6.
- ThermoRetec. 2001. Kalispell Pole & Timber Data Summary Report, Kalispell, Montana: Volume 1 of 2: Report and Appendix A. July 17.
- U.S. Department of Energy (DOE). 1995. Guide for Performing Screening Ecological Risk Assessments at DOE Facilities. September.
- DOE. 1997. A Framework for Assessing Ecological Risks of Petroleum-Derived Materials in Soil. May.
- U.S. Environmental Protection Agency (EPA). 1992a. Preliminary Extent of Soil Contamination and Hydrogeological Investigation, Kalispell Pole and Timber Site, Kalispell, Montana. Prepared by Roy F. Weston. Final report. February.
- EPA. 1992b. "Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers." OSWER Directive No. 9240.0-05A. April.
- EPA. 1994. "National Functional Guidelines for Inorganic Data Review." Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-94/013. February.
- EPA. 1996. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Update III." Office of Solid Waste and Emergency Response. Washington, DC. December.
- EPA. 1999a. "U.S. EPA Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration." Document Number OLM04.2. May.
- EPA. 1999b. "National Functional Guidelines for Organic Data Review." Office of Emergency and Remedial Response. Washington, DC. EPA-540/R-99-008. October.
- EPA. 2000a. "U.S. EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration." Document Number ILM04.1. January.

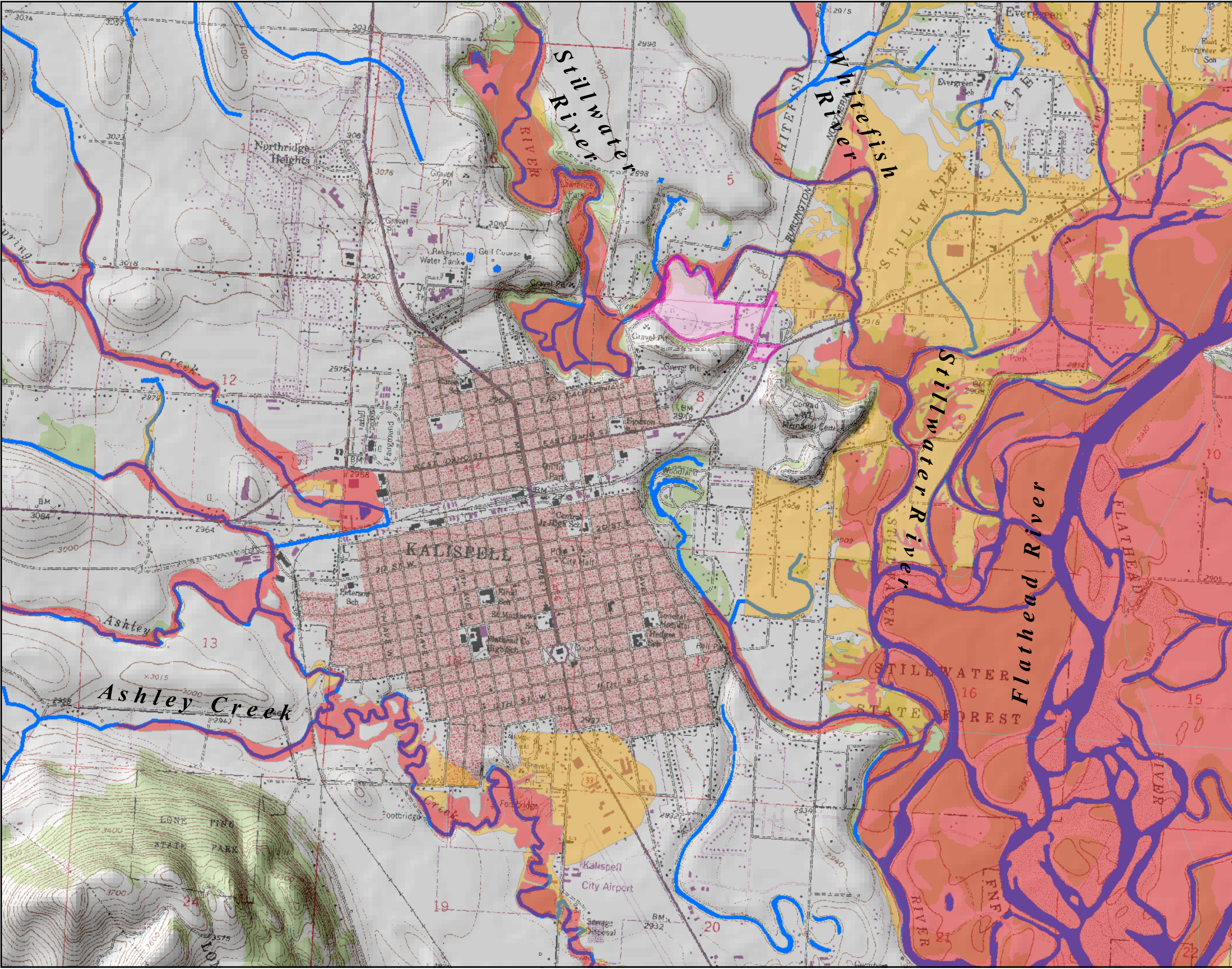
## REFERENCES (Continued)

- EPA. 2000b. "Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA QA/G-4HW)." Office of Environmental Information. Washington, D.C. EPA/600/R-00/007. January.
- EPA. 2000c. "Guidance for Data Quality Assessment, Practical Methods for Data Analysis, EPA QA/G-9, QA00 Update." Office of Environmental Information. Washington, D.C. EPA/600/R-96-084. July.
- EPA. 2000d. "Guidance for the Data Quality Objectives Process, EPA QA/G-4." Office of Environmental Information. Washington, DC. EPA/600/R-96/055. August.
- EPA. 2001. "EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5." Office of Environmental Information. Washington, DC. EPA/240/B-01/003. March.
- EPA. 2004. *Region 9 Preliminary Remediation Goals 2004 Table*. October. Available on line at <http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf>
- Washington State 1997. "Washington State Department of Ecology's Creation and Analysis of Freshwater Sediment Quality Values in Washington State." July.



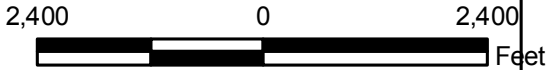
**APPENDIX COVERS IN INDIVIDUAL FOLDERS**





- Legend**
- Approximate Facility Boundary
  - FEMA Mapped Floodplains
  - 100 Year Floodplain
  - 500 Year Floodplain

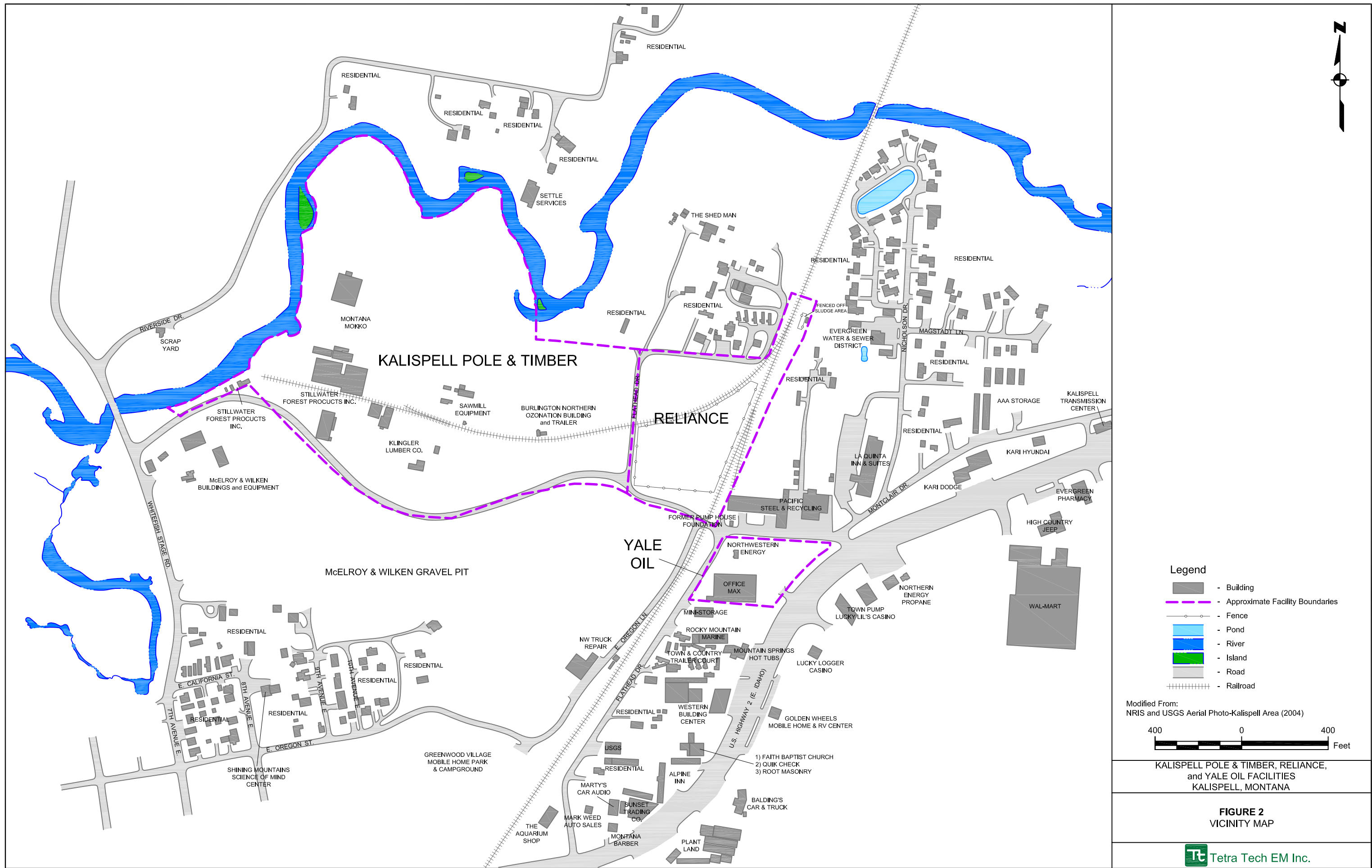
Source:  
Floodplains from Federal Emergency Management  
(FEMA) Q3 GIS data, 2005.



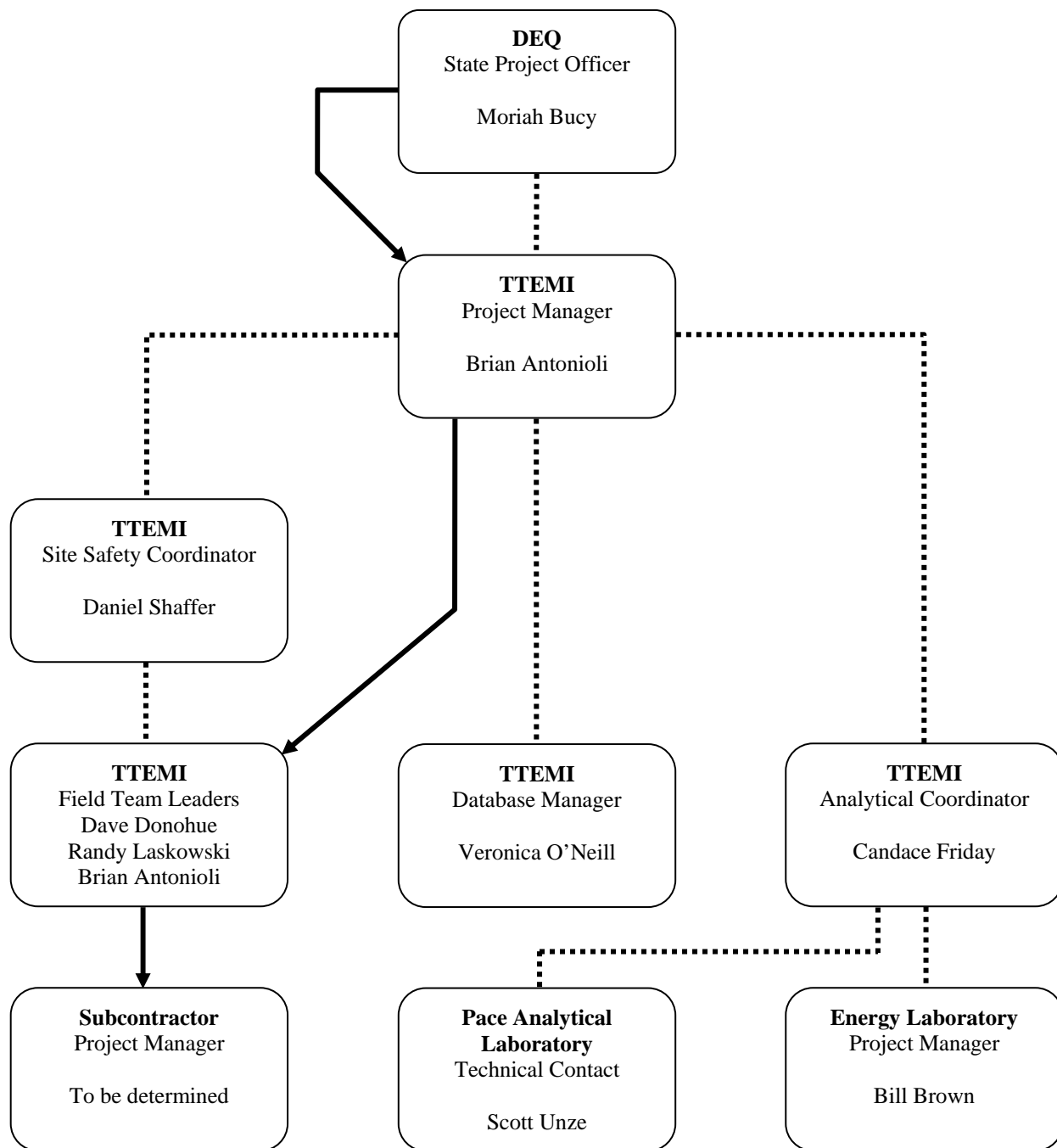
KALISPELL POLE & TIMBER, RELIANCE,  
and YALE OIL FACILITIES  
KALISPELL, MONTANA

**FIGURE 1**  
**SITE LOCATION MAP**









Line of Authority  
Line of Communication



KALISPELL POLE & TIMBER, RELIANCE,  
and YALE OIL FACILITIES  
KALISPELL, MONTANA

**FIGURE 4**  
PROJECT ORGANIZATION CHART



